THE BRITISH PHARMACEUTICAL CONFERENCE.

AN ORGANIZATION FOR THE ENCOURAGEMENT OF PHARMACEUTICAL RESEARCH AND THE PROMOTION OF FRIENDLY INTERCOURSE AMONGST PHARMACISTS.

This Association of Chemists and Druggists and others interested in Pharmacy is managed by about twenty unpaid officers annually elected by the members.

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The chief business of the meetings is the communication of written descriptions of original investigations made by members during the year, and includes discussions on such papers by the assembled members and visitors.

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THE YEAR-BOOK OF PHARMACY.

The Conference annually presents to members a handsome octavo volume of 500 or 600 pages, containing the proceedings at the yearly meeting and a report on the progress of pharmacy, or Year-Book, comprising abstracts of papers on pharmacy, materia medica, and chemistry, and on new preparations, processes, and formulæ, published at home and abroad during each year. The funds of the Conference, composed of annual subscriptions of seven shillings and sixpence, are devoted to the production of this useful book, no pains being spared to make it the desk companion of the year, and an invaluable permanent work of reference for chemists and druggists and others interested in pharmacy. The Executive Committee of the Conference trusts that members will show the current Year-Book to their friends and acquaintances—principals, assistants, or pupils—and obtain as large a number of new members as possible. Alphabetical lists of (1) the names and addresses of subscribers, and (2) of the towns in which they reside, will be found in each Year-Book.

NOMINATION FOR MEMBERSHIP.

Gentlemen desiring to join the Conference can be nominated at any time on applying to either of the officers or members. No special form of nomination is required. The Name and Address of each candidate to be written legibly, and forwarded to the Hon. Secretary, Professor Attfield, 17, Bloomsbury Square, London, W.C., who will sign the paper, if a member's name is not already appended. The subscription may be sent at the same time.

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The Annual Subscription is Seven Shillings and Sixpence, payable in advance. For this sum each member is entitled to one copy of the Year-Book, carriage free; and to attend the Annual Meetings.

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Remittances may be by Post Office Order, made payable to John Attfield, at "High Holborn," or by stamps or cheque.

The Conference year commences on July 1st, and Annual Subscriptions are due in advance on that date. They may be sent then or soon afterwards to the London Secretary. The Year-Book is posted as soon as published (in December) to every member who has previously paid his subscription. To members joining later the volume is posted immediately on receipt of a Money Order or other form of remittance. Members may still obtain, by post, any number of copies of the "1870" Year-Book (the first issued), or that for 1871 or 1872 on remitting 5*s.* 6*d.* per copy —foreign members, 7*s.* 6*d.* The price of extra copies of the volume for 1873, or subsequent issues, will be 7*s.* 6*d.*, post free,—foreign members, 10*s.* Price of the Year-Book to non-members, exclusive of postage, 10*s.*

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COMPRISING

ABSTRACTS OF PAPERS

RELATING TO

PHARMACY, MATERIA MEDICA, AND CHEMISTRY

CONTRIBUTED TO BRITISH AND FOREIGN JOURNALS,

FROM JULY 1, 1876, TO JUNE 30,

1877.

WITH THE

TRANSACTIONS

OF THE

BRITISH PHARMACEUTICAL CONFERENCE

AT THE

FOURTEENTH ANNUAL MEETING

HELD IN

PLYMOUTH,

AUGUST, 1877.

LONDON:
J. & A. CHURCHILL, 11, NEW BURLINGTON STREET.
MDCCCLXXVII.

British Pharmaceutical Conference.

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THE

BRITISH PHARMACEUTICAL CONFERENCE.

AN ORGANIZATION ESTABLISHED IN 1863 FOR THE ENCOURAGEMENT OF PHARMACEUTICAL RESEARCH, AND THE PROMOTION OF FRIENDLY INTERCOURSE AND UNION AMONGST PHARMACISTS.

THE most important ways in which a member can aid the objects of the Conference are by suggesting subjects for investigation, working upon subjects suggested by himself or by others, contributing information tending to throw light on questions relating to adulterations and impurities, or collecting and forwarding specimens whose examination would afford similar information. Personal attendance at the yearly gatherings, or the mere payment of the annual subscription, will also greatly strengthen the hands of the executive.

A list of subjects suggested for research, is sent to members early in the year. Resulting papers are read at the annual meeting of the members; but new facts that are discovered during an investigation may be at once published by an author at a meeting of a scientific society, or in a scientific journal, or in any other way he may desire; in that case, he is expected to send a short report on the subject to the Conference.

The annual meetings are usually held in the provinces, at the time and place of the visit of the British Association; that for 1878 will be held in Dublin on Tuesday and Wednesday, the 13th and 14th of August.

Gentlemen desiring to join the Conference, can be nominated at any time on applying to either of the secretaries or any other officer or member. The yearly subscription is seven shillings and sixpence, payable in advance, on July 1st. Further information may be obtained from the secretaries—

PROFESSOR ATTFIELD, 17, Bloomsbury Square, London, W.C.
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THE YEAR-BOOK OF PHARMACY.

The Conference annually presents to members a volume of 500 to 600 pages, containing the proceedings at the yearly meeting, and an Annual Report on the Progress of Pharmacy, or Year-Book, which includes notices of all pharmaceutical papers, new processes, preparations, and formulæ published throughout the world. The necessary funds for accomplishing this object consist solely of the subscriptions of members. The Executive Committee, therefore, call on every pharmacist—principal, assistant, or pupil—to offer his name for election, and on every member to make an effort to obtain more members. The price of the Year-Book to non-members is ten shillings. The constitution and rules of the Conference, and a convenient form of nomination, will be found at page 345.

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INTRODUCTION.

The record of pharmaceutical research forms an important if but a small part of the scientific literature of the year. A period of bustling activity, embracing as it does the numerous and not wholly unsensational reports on jaborandi and salicylic acid, has been followed by an interval of comparatively quiet but none the less valuable research. Many new observations full of interest to pharmacists have been made, older ones have been confirmed, others disproved, and fresh light has been shed on subjects which hitherto appeared in an almost hopeless state of confusion. As a striking instance in which skill and perseverance combined have raised an important subject of investigation from a condition little better than chaos to a fruitful field of inquiry, we refer to the chemistry of aconite root, as elucidated by successive annual contributions to the British Pharmaceutical Conference, and especially by the reports presented to its recent meeting at Plymouth by Dr. Wright, Mr. Groves, Mr. Williams, Dr. Paul and Mr. Kingzett. The three chemists first named constitute a committee specially appointed at the previous meeting to continue investigations on the aconite bases. From these and former reports it appears that the roots of *Aconitum Napellus* contain three distinct alkaloids, viz. aconitine, $C_{33}H_{43}NO_{12}$, a highly active crystallizable body, furnishing crystallizable salts; pseudaconitine, $C_{36}H_{49}NO_{11}$, likewise active and crystallizable, but not readily yielding crystallized combinations; and an amorphous base with a higher percentage of carbon, yielding non-crystalline salts, and possessing little physiological potency. The amorphous, bitter, inert alkaloid, furnishing well crystallized salts and answering to the formula $C_{31}H_{45}NO_{10}$, which Mr. Groves isolated from one batch of roots (see *Year-Book of Pharmacy*, 1875, p. 514), is now distinguished from the other bases by the name picraconitine. The roots of *Aconitum ferox* are shown to contain comparatively large quantities of pseudaconitine, besides a small amount of aconitine and an amorphous base with a larger percentage of carbon, which, however, does not appear to be identical with the analogous body from *Aconitum Napellus*.

The results of Messrs. Paul and Kingzett's researches on Japanese aconite point to the existence therein of a crystallizable alkaloid of the formula $C_{29}H_{43}NO_9$, differing from any of the bases described by other observers. In Dr. Wright's opinion this substance is not a distinct alkaloid, but a mixture of pseudaconitine and decomposition products thereof; but this view is stoutly contested by the two authors just named. The latter, on the other hand, incline to the belief that the various bodies which have been described as aconite bases may be combinations of alkaloids with aconitic or some other organic acid; and that it is doubtful whether the alkaloid or alkaloids to which the medicinal properties of aconite are ascribed have ever yet been obtained in a separate state. That some diversity of opinion should still continue to exist on this subject appears the less surprising in view of the great difficulties connected with its investigation, arising mainly from the great tendency of these alkaloids to undergo changes during their extraction and purification. The nature of these changes, so readily brought about under various influences, form one of the leading features of the Committee's report already referred to, and is briefly represented by the following equations:—

$$(1)\quad \underset{\text{Aconitine.}}{C_{33}H_{43}NO_{12}} + H_2O = \underset{\text{Benzoic acid.}}{C_7H_6O_2} + \underset{\text{Aconine.}}{C_{26}H_{39}NO_{11}}$$

$$(2)\quad \underset{\text{Pseudaconitine}}{C_{36}H_{49}NO_{11}} + H_2O = \underset{\text{Dimethylprotocatechuic acid.}}{C_9H_{10}O_4} + \underset{\text{Pseudaconine.}}{C_{27}H_{41}NO_8}$$

These decomposition products never fail to be present in the extract prepared from aconite roots, and in the aconitine of commerce. The latter appears to be a mixture of true aconitine and pseudaconitine, with variable quantities of aconine and pseudaconine, and of the amorphous unnamed alkaloids above alluded to. A process for its analysis will be found on page 464 of this volume, as part of the report.

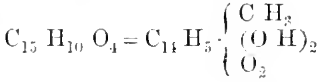
Prof. Dragendorff's statement that Tanret's ergotinine was not a chemically distinct substance, but a mixture owing its activity to the presence of sclererythrin, is contradicted by M. Tanret, who supplies analytical evidence to show that his alkaloid does not contain even a trace of this body. Sclerotic acid, claimed to be the active principle of ergot, is dealt with by its discoverers, Prof. Dragendorff and M. Podwissotzky, in a second report containing detailed information respecting the process employed for its extraction. Prof. Buchheim, on the other hand, is still of opinion that no alkaloid or glucoside fully representing the active properties of ergot has as yet been, or is ever likely to be, isolated from the drug, and that the freshly prepared extract alone can be depended upon for medicinal purposes.

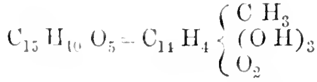
There can be no longer any reasonable doubt that the reported conversion of brucine into strychnine by the action of dilute nitric acid was an illusion; for as such it must appear in the absence of evidence to the contrary from the results of experiments on this subject conducted by Mr. A. J. Cownley, and more recently by Mr. W. A. Shenstone. In both reports attention is drawn to the facility with which traces of strychnine and brucine are destroyed by dilute nitric acid, an important point in forensic investigations. A new process for the detection of these and other poisonous alkaloids in analyses of this kind is recommended by Prof. Dragendorff; its chief feature consisting in the application of benzol and petroleum ether as solvents.

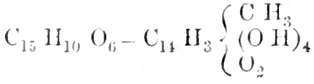
Dr. Paul criticises the official test of the purity of quinine sulphate, showing that it fails to indicate the presence of less than ten per cent. of sulphate of cinchonidine, this failure being due to an increased solubility of cinchonidine in ether in the presence of quinine. He prefers to rely on the process of fractional crystallization, whereby the cinchonidine sulphate, as the more soluble salt of the two, remains in the mother-liquor, in which it may then be readily detected by the official test. In an examination of nine samples of commercial quinine sulphate, he found cinchonidine in all cases, varying in amount from one to ten per cent. Equally important to pharmacists is the same author's observation that some of the citrate of iron and quinine sold as the preparation of the British Pharmacopœia is lamentably deficient in alkaloid, and still more so in actual quinine. The amount of water of crystallization in freshly prepared quinine sulphate has been variously stated as 7, 7½, and 8 molecules. According to a recent determination by Mr. Cownley, it amounts to 7½ molecules, of which 5 molecules are rapidly lost by efflorescence; the salt becomes anhydrous at 100° C., but re-absorbs 2 molecules of water upon exposure to the air. Aricine, it seems, must be erased from the list of cinchona alkaloids, since Dr. O. Hesse's examination of this substance and the so-called cinchovatine affords the strongest ground for regarding both as impure cinchonidine.

The alteration which acetate of morphine is known to undergo on keeping is attributed by Mr. E. Merck to a continual though slow elimination of acetic acid, resulting in the formation of a basic salt less soluble in water but unimpaired in its active properties. So long as the preparation does not assume a very distinct yellow coloration, indicating a further and more complicated decomposition, it remains fit for medicinal use. Analyses of veratrine performed by Messrs. E. Schmidt and R. Koppen show that the composition of the crystallized alkaloid in its purest form is represented by the formula $C_{32} H_{35} N O_9$, and that the commercial preparation is tolerably pure. Of the various salts of conine, the hydrobromate is the one most easily obtainable in a crystallized state. A convenient mode of preparation, together with a description of its properties, and suggestions respecting its medicinal application, form the subject of a paper by M. Mourrut. The results of an analysis of the platinum salt of pilocarpine have convinced Mr. Kingzett of the identity of this alkaloid with that to which he has previously assigned the formula $C_{23} H_{34} N_4 O_4$.

Dr. Schmidt's researches on the aloin of Barbadoes aloes confirm the correctness of the formula $C_{16} H_{18} O_7$ previously established by Dr. Tilden, and show that this aloin, like that of Zanzibar aloes, may crystallize with either one, two, or three molecules of water. Regarding the oxidation products of barbaloin and socaloin, Dr. Tilden reports that, whereas the action of nitric acid on these substances yields chrysammic acid, their treatment with bichromate results in the formation of a peculiar yellow compound of the formula $C_{15} H_{10} O_6$, named by him *aloxanthin.* When heated with zinc dust this body furnishes methylanthracene, the same product as obtained by Messrs. Graebe and Liebermann, and subsequently by Dr. Schmidt, in the same way direct from aloin. As a point of special interest, Dr. Tilden calls attention to the relation between aloxanthin and the two yellow constituents of rhubarb, chrysophanic acid and emodin, as becoming evident on comparison of their formulæ:—

Chrysophanic Acid,

$$C_{15} H_{10} O_4 = C_{14} H_5 \left\{ \begin{array}{l} C H_3 \\ (O H)_2 \\ O_2 \end{array} \right.$$

Emodin . . . .

$$C_{15} H_{10} O_5 = C_{14} H_4 \left\{ \begin{array}{l} C H_3 \\ (O H)_3 \\ O_2 \end{array} \right.$$

Aloxanthin .

$$C_{15} H_{10} O_6 = C_{14} H_3 \left\{ \begin{array}{l} C H_3 \\ (O H)_4 \\ O_2 \end{array} \right.$$

from which these compounds appear as di-, tri-, and tetra-oxyderivatives of methylanthraquinone.

Amyrin, the principal constituent of elemi, has been reinvestigated by Dr. E. Buri, who gives the formula $C_{25} H_{42} O$, or $(C_5 H_8)_5 H_2 O$, as the proper representation of its composition. According to Prof. Flückiger it is associated in elemi with icacin, $(C_5 H_8)_9 H_2 O$, bryoidin, $(C_5 H_8)_4 H_2 O$, and a volatile oil, $(C_5 H_8)_2$. Dr. Buri's analysis of capsaicin, the pungent principle isolated from capsicum fruit by Mr. Thresh, leads to the formula $C_9 H_{14} O_2$, the correctness of which is now confirmed by Mr. Thresh's own determinations. Kosin, a crystalline body prepared by Dr. Merck, and described by Professor Flückiger (see *Year-Book of Pharmacy*, 1875, p. 19), is now asserted by Professor Buchheim to be, not merely a definite chemical constituent of cusso, but also its real active principle, and as such it is recommended by him to the notice of the medical profession.

Artificially prepared oil of mustard is generally regarded as identical with the natural product, and so it unquestionably would be if it were prepared from allyl iodide and potassium sulphocyanide; but as such a preparation would be more costly than the oil obtained from black mustard seeds, the artificial oil of commerce is probably the unpurified product of the dry distillation of a mixture of potassium allyl-sulphate and sulphocyanide, and as such it is hardly fit for therapeutic purposes. Dr. E. Mylius, who reports on this subject, finds that the best artificial oil met with in German commerce contains about eight per cent. of impurities. In a valuable contribution to the chemistry of essential oils presented to the British Pharmaceutical Conference, Dr. Tilden records the results of a further study of the action of nitroxyl chloride ($N O Cl$) on various terpenes of the formula $C_{10} H_{16}$. The results of this reaction enable him not only to distinguish true terpenes from the polymeric hydrocarbons of the formulæ $C_{15} H_{24}$, $C_{20} H_{32}$, etc., but also to distinguish between various true terpenes obtained from different sources. He arrives at the conclusion that the terpenes from several different plants are really indentical and not simply isomeric. This he believes to be the case with the terpenes from French turpentine, juniper, and sage; also with those from orange peel, bergamot, and lemon. Thus he divides the natural terpenes into two groups, viz., the turpentine group and the orange group, differing from each other by their boiling point, the melting points of their nitroso-derivatives, and other features. The difference in odour which the members of either group exhibit is attributed by him to the presence of small quantities of the heavier constituents of the oils, which it is almost impossible to separate completely by distillation. The oils of lavender and savin do not appear to be terpenes, as even their most volatile fractions contain oxygen. The oils of caraway and sage, however, contain terpenes besides oxygen compounds. The latter forms the subject of an elaborate report by Messrs. M. M. Pattison Muir and S. Sugiura, which was also read at the Plymouth meeting of the Conference. A reinvestigation of the stearopten of oil of cubebs, by Dr. E. Schmidt, confirms the correctness of the formula $C_{15} H_{24}. H_2 O$, which had been called in question by Messrs. J. Jobst and O. Hesse.

Mr. E. F. Teschemacher recommends a process for the assay of opium, the main points of which consist in the avoidance of the use of alcohol for extracting the morphine, and the separation of the meconic acid at an early stage, thus preventing the formation of a basic meconate on precipitation of the morphine. The same subject is treated in a supplementary note to his previous report by Mr. B. S. Proctor, in which he suggests some further improvements respecting the exhaustion of opium by percolation.

The manufacture of sodium carbonate from common salt by the so-called ammonia process is already undergoing important modifications. Hitherto, the main step in the process was the formation of sodium bicarbonate (see *Year-Book of Pharmacy*, 1874, p. 171). The improvement now introduced is based upon the comparative insolubility of monohydrated sodium carbonate ($Na_2 C O_3. H_2 O$) in a concentrated solution of sodium chloride. This carbonate crystallizes at 60°–70° C. from a mixed saturated solution of ammonium carbonate and common salt containing the latter in excess. It is converted into the ordinary carbonate, $Na_2 C O_3. 10 H_2 O$, by simple recrystallization.

The question, whether two different salts, when dissolved together in water, exist in the solution in the same condition in which they were introduced, or whether they suffer a mutual decomposition, is difficult to decide in cases in which such a decomposition does not result in the formation of an insoluble or difficultly soluble combination. Some light is thrown on this subject by Dr. H. C. Dibbits, who bases his conclusions on the different quantities of ammonia lost by solutions of different ammonium salts upon boiling. By dissolving equivalent proportions of ammonium sulphate and potassium chloride, and determining the loss of ammonia on boiling, so as to ascertain whether this loss is equal to that ocurring with ammonium sulphate, or to that ocurring with ammonium chloride, he finds the boiled solution to contain ammonium chloride, ammonium sulphate, potassium chloride, and potassium sulphate. With other salts of potassium and ammonium the results are the same, proving in each case a partial decomposition of the salts employed.

The chemical constitution of chlorinated lime seems to afford an unlimited scope for the exercise of chemical ingenuity, for year after year brings fresh contributions to its literature. The most recent report on this subject is one by Mr. C. Stahlschmidt, in whose opinion bleaching powder contains no free calcium hydrate whatever, but has a composition represented by the formula $2\,Ca\,H\,Cl\,O_2 + Ca\,Cl_2 + 2\,H_2O$, its main constituent being a calcium hydro-oxychloride, $Ca\,H\,Cl\,O_2$, or $Ca\left\langle\begin{matrix}O\,H\\ O\,Cl\end{matrix}\right.$, which he believes to be formed by the replacement of an atom of hydrogen in calcium hydrate by an atom of chlorine. The calcium chloride he regards as standing outside the constitution of chlorinated lime.

Turning now to that branch of chemical literature more particularly devoted to the methods of analysis, we have again to record a number of processes more or less directly valuable to pharmacists. Mr. M. M. Pattison Muir estimates bismuth volumetrically, by adding a titrated solution of potassium dichromate to a nearly neutral solution of bismuth nitrate until the whole of the metal is precipitated as chromate. The final point of the reaction is determined by bringing a drop of the supernatant liquid into contact with a drop of solution of silver nitrate, when the slightest excess of the test will be indicated by the formation of red silver chromate. The titration of nitric acid by indigo requires certain precautions and conditions, the details of which form the subject of a paper by Mr. R. Warington. Professor F. Stolba has rendered good service to analysts by showing that the estimation of phosphoric acid and magnesium by precipitation as ammonio magnesium phosphate, etc., may be effected volumetrically. Instead of igniting the washed precipitate and weighing it as pyrophosphate, it is only necessary to determine its alkalinity by means of deci-normal hydrochloric acid, using cochineal as an indicator. Arsenic acid may be estimated in the same manner. The action of the acid on the precipitate is explained by the following equation:—

$$Mg.\,N\,H_4.\,P\,O_4 + 2\,H\,Cl = N\,H_4.\,H_2.\,P\,O_4 + Mg\,Cl_2;$$
$$Mg.\,N\,H_4.\,As\,O_4 + 2\,H\,Cl = N\,H_4.\,H_2.\,As\,O_4 + Mg\,Cl_2.$$

If magnesium is to be estimated in the presence of calcium, the latter need only be precipitated by ammonium oxalate in the presence of ammonium chloride, and the magnesium then thrown down by sodium phosphate and ammonium hydrate, without removing the calcium oxalate by filtration, for the oxalate does not interfere in the least with the titration of the magnesium precipitate. We have had occasion to try his process and are much pleased with the results. It is evident that the officinal sodium phosphate, $Na_2. H. P O_4$, may thus be directly titrated without being first converted into ammonio magnesium phosphate:—

$$Na_2. H. P O_4 + H Cl = Na. H_2. P O_4 + Na Cl;$$

or after ignition:—

$$Na_4. P_2 O_7 + H_2 O + 2 H Cl = 2 Na H_2 P O_4 + 2 Na Cl.$$

Mr. H. Pellet points out that chlorides can be readily titrated in the presence of phosphates by acidifying the solution with nitric acid, then neutralizing with calcium carbonate, and afterwards determining the chlorine by means of standard silver nitrate and potassium chromate in the usual manner. The same chemist, in conjunction with M. F. Jean, suggests the application of baryta water and a titrated acid for the volumetric estimation of oxalates. Tannin is recommended by Mr. H. Kämmerer as a reagent in water analysis on account of its power of precipitating gelatinous and albuminoid matters. A handy process for estimating magnesia in potable waters is proposed by Mr. L. Legler, and consists mainly in the precipitation of the magnesium as hydrate by a known quantity of sodium or potassium hydrate, and the titration of the excess of alkali by standard sulphuric acid. In estimating potassium and sodium in a mixture of their carbonates by the so-called indirect method, it was hitherto the rule first to convert the carbonates into chlorides or sulphates. This Dr. Wittstein shows to be unnecessary, as the relative proportions of the two carbonates may be equally well calculated from the quantity of carbonic acid the mixture is found to contain. Mr. W. F. Koppeschaar bases a volumetric process for the estimation of phenol on its well-known reaction with bromine water. The latter is added in excess to ensure complete precipitation of the phenol as $C_6 H_2 Br_3 O H$, and the excess of the reagent determined by potassium iodide and standard solution of sodium hyposulphide. The separation and detection of arsenic in forensic analyses is best effected, according to Mr. J. A. Kaiser, by heating the suspected organic matter with sulphuric acid and sodium chloride, and converting the chloride of arsenic now contained in the distillate into arsenic acid by means of potassium chlorate. The product is then in a suitable condition for examination by Marsh's test or any of the usual methods. For the quantitative determination of traces of this poison in mineral and organic substances, M. Crommydes strongly recommends Gautier's process, which consists in the evolution of the arsenic from a Marsh's apparatus in the form of arseniuretted hydrogen, and the direct weighing of the metallic arsenic deposited in the combustion tube. On theoretical grounds we cannot but doubt the accuracy of this method, for it is well known that an appreciable portion of the arsenic introduced into Marsh's apparatus remains in it as such with the zinc. The results of M. Crommydes' experiments, however, exhibit nevertheless a high degree of accuracy, and such being the case, we beg to recommend this apparently very handy and expeditious process to the further notice of critical investigators.

The analysis of food and drugs, or rather the detection of adulteration therein, is a subject which during the last six years has received so many contributions that it may almost be said to have a literature of its own. This is no doubt a direct consequence and, we venture to say, one of the best results of the Adulteration Act, a result which, we trust, may long continue to accrue from its operation. During the current year the published researches bearing on this subject have been fewer in number than heretofore, but this is probably to be regarded merely as a temporary lull to be followed by an increased activity. One of the most difficult tasks a public analyst may be called upon to perform, and one which but a few years ago would have been wholly beyond his power, is the detection and estimation of admixtures of foreign fats in butter. Even now the processes employed for this purpose can hardly be said to be entirely satisfactory, but they have unquestionably been much advanced by the researches of Messrs. Angell and Hehner, and more recently by the reports of Dr. Muter and Dr. Dupré, from which it appears that the specific gravity of the butter fat, together with its percentages of soluble and insoluble fatty acids, afford a fairly reliable indication of the presence or absence of adulteration. An excellent and withal very simple mode of detecting mineral acids in vinegar is recommended by Mr. Hehner, who relies for this purpose on the reaction of the ash. The traces of alkaline acetates and tartrates invariably occurring in vinegar are converted into carbonates by incineration, and thus impart an alkaline reaction to the ash. An admixture of sulphuric or hydrochloric acid would convert these acetates and tartrates into sulphates or chlorides; thus causing the ash of such vinegar to be neutral to test paper. The quantity of the adulterant is ascertained by mixing the vinegar with a measured volume of deci-normal solution of soda, evaporating the mixture to dryness, incinerating the residue, and determining the loss of alkalinity by titration with deci-normal sulphuric acid. This process is likewise applicable for the estimation of mineral acids in adulterated lime or lemon juice. Sulphuric acid may also be detected in vinegar by means of a reaction of colchicine described by Prof. Flückiger. The same chemist reports on the characters of gurjun oil, and its detection in copaiba by means of carbon bisulphide and a mixture of sulphuric and nitric acids. For the determination of fatty oils in adulterated copaiba, Dr. Muter makes use of a process based on the different degrees of solubility of the sodium salts of oleic and copaivic acids in a mixture of ether and alcohol. Mr. Greenish supplies pharmacists with some further valuable information concerning the use of the microscope for the detection of adulteration, by drawing attention to the distinctive character of cassava starch, the produce of *Manihot utilissima*, which has been repeatedly observed as an adulterant of arrowroot. The same instrument is shown by Mr. W. J. Clark to afford a ready means for the recognition of an admixture of seed or rind with the powdered pulp of colocynth. An unusual amount of attention has been devoted to the testing of wines, and the detection therein of fuchsine and other artificial colouring matters. Abstracts of the most important papers bearing on this subject will be found in this volume. The influence of desiccation and other modes of preservation of various vegetable articles of food forms the subject of a chemical study by Prof. Attfield, the results of which are embodied in an interesting report read at the Plymouth meeting of the British Pharmaceutical Conference.

The question whether or not copper is to be considered a poison has been much discussed of late, without leading to anything like unanimity of opinion. It appears to be generally conceded, however, that this metal is not a poison in the same sense in which arsenic, lead, and mercury are termed poisons; it does not directly produce fatal effects, and workmen engaged in its production and in the manufacture of its salts do not seem to suffer in health from their occupation. Messrs. Paul and Kingzett believe that preserved peas coloured with small quantities of copper salts, such as those largely imported from France, are perfectly harmless, basing their opinion on the observation that the greater part of this metal thus introduced into the stomach is eliminated with the fæces. All that is positively known respecting the action of copper, is that in large or even in moderate doses it produces vomiting and other violent symptoms, and that in smaller doses it produces astringent effects;

but whether the regular and long continued introduction of minute quantities, such as occur in coloured vegetables, may or may not be detrimental to health, is at present, we think, an open question, the final solution of which lies outside the sphere of chemical research.

MM. Dujardin Beaumetz and Audigé have studied the effects on dogs of hypodermic injections of glycerin, and arrive at the conclusion that, when administered in large doses, this substance possesses decided toxic properties, producing symptoms analogous to those of acute alcoholism. This fact, apart from its therapeutic value, cannot fail to be interesting to chemists who regard glycerin as an alcohol of the formula $C_3 H_5 3 H O$.

Among the vegetable drugs which during the present year have formed the objects of chemical and medical research, there are not many that can be classed as new remedies, the majority of them having met with previous notices. *Xanthium spinosum* is introduced as a remedy for hydrophobia, and strongly recommended as such by Dr. Grzymala. M. Guichard, who deals with the chemistry and pharmacy of this drug, considers an alcoholic extract as the best form for its administration, and states that he has obtained indications therein of the presence of an alkaloid which he soon hopes to isolate. Olive-tree bark is spoken of as a valuable febrifuge, owing its therapeutic properties to a principle similar in its action to quinine, to which the name oliverine has been given. The same properties are attributed to the so-called quinine flower, a drug derived from a gentianaceous plant growing in Florida. The root of *Sium latifolium*, a Californian plant belonging to the order *Umbelliferæ*, is reported to possess toxic properties, resembling those of digitalis and due to a resinous constituent. Maté, or Paraguayan tea, is said to be obtained from the leaves and young branches of *Ilex mate paraguayensis*, and to contain a considerable amount of caffeine; its prolonged use as a beverage appears to prove injurious to the heart and digestive organs. The root of *Megarrhiza Californica* is described as a strong drastic and hydragogue purgative, owing its action to a glucoside named megarrhizin, which agrees in many of its chemical and physical properties with colocynthin and bryonin, but is not identical with either. The alcoholic extract of the root may be administered in doses varying from an eighth of a grain to half a grain, and will probably prove very useful in dropsical conditions, as it also augments the urinary discharges; in large doses it is a powerful irritant, causing gastroenteritis and death. An alkaloid named timbonine has been isolated by M. Martin from the root bark of timbo (*Paullinia pinnata*), a

Brazilian drug which is used in the form of poultices as an irritant. Mr. A. Kopp gives a description of an odorous resin, called *resina guaiaci peruviana aromatica*, the origin of which is as yet unknown. It is stated to be entirely different from true guaiacum resin, and to yield upon distillation with water a volatile oil the odour of which resembles a mixture of peppermint and lemon. Hoang-Nan is the name of a bark which is said to be much esteemed in Tong-King (in Eastern Asia) as a remedy for hydrophobia. Specimens of this drug received and examined by M. Planchon correspond in every particular with the bark of *Strychnos nux vomica*. The description of a large number of Indian drugs, their botanical sources, and the uses to which they are applied, forms the subject of an interesting and very extensive report by Prof. Dymock, published in the Pharmaceutical Society's Journal.

Mr. J. Jobst reports that his attempts to prepare cotoin from recent importations of cota bark have failed in their immediate object, but have led to the isolation, by the same process which previously yielded cotoin (see *Year-Book of Pharmacy*, 1876, p. 150), of a body similar to and possessing the same therapeutic properties as cotoin. This he proposes to call *paracotoin*. The bark itself differs from that previously operated upon in its external appearance as well as in its odour and taste. A subsequent examination of the recently imported bark shows the presence therein of four distinct crystalline principles, viz. *paracotoin*, $C_{19}H_{12}O_6$; *leucotin*, $C_{21}H_{20}O_6$; *oxyleucotin*, $C_{21}H_{20}O_7$; and *hydrocotoin*, $C_{22}H_{20}O_6$. Cotoin is now found to have a composition corresponding to the formula $C_{22}H_{18}O_6$, from which paracotoin appears to be a homologue differing by C_3H_6. The latter, notwithstanding its high price, is finding much favour as a remedy against all forms of diarrhœa.

MM. Gallois and Hardy publish the details of a chemical investigation of mancona bark, the produce of *Erythrophlæum guineense*, resulting in the isolation of a strongly poisonous alkaloid, to which they give the name *erythrophleine*. It resembles strychnine in its reaction with potassium permanganate and sulphuric acid, but the coloration thus produced is less intense, and soon changes to a dirty brown. The bark of *Galipea Cusparia*, commonly known as angostura bark, has also furnished a new alkaloid, which Messrs. Oberlin and Schlagdenhauffen find to be soluble in ether, chloroform, and benzoline, and to differ entirely from Saladin's *cusparine*. On the other hand, the asserted existence of an alkaloid in scammony root is disputed by Messrs. Kingzett and Farries. Resin of scammony, according to the same authors, is a glucoside, differing but little from jalapin. The toxic properties of Persian insect powder (the flowers of *Pyrethrum caucasicum*) also appear to be due to a glucoside, for such the body named persicin, prepared and described by Mr. R. Rother, proves to be.

The active properties of Indian hemp have hitherto been ascribed to its resinous constituents. Dr. Preobraschensky, however, shows that commercial hashish, as well as the flowering tops of the plant, and the pure extract prepared therefrom, all contain a volatile alkaloid which, in odour, taste, the crystalline forms of its salts, and its reactions with platinic chloride and other tests, corresponds exactly with nicotine. Two grams of the extract distilled with lime and potash furnished 63·5 milligrams of nicotine.

Professor Buchheim's research on the constituents of black pepper establishes the fact that the amorphous substance previously denoted as "resin," is a distinct principle, which, like piperin, yields piperidin when treated with alcoholic solution of potash. While piperin may be regarded as piperidin, $C_5 H_{10} H N$, in which one atom of hydrogen is replaced by piperic acid, $C_5 H_{10} (C_{12} H_8 O_3) N$, chavicin, the body referred to, is to be considered as piperidin in which an atom of hydrogen is replaced in a similar manner by chavicic acid. A part of Mr. Thresh's report on cayenne pepper deals with the fatty matter obtained from it, proving free palmitic acid to be its predominating constituent.

Pumpkin seeds, according to Mr. E. Heckel, owe their anthelmintic action to a resinous substance contained in the outer layer of the fourth or innermost coat of the seed, and not, as was formerly supposed, to the fatty oil residing in the cotyledons. Owing to the absence of this papyraceous membrane, which alone contains the resin, in other cucurbitaceous seeds, the latter are said to be inert. At the same time it is shown that even active seeds become inert by being blanched in a fresh state, as all the coats are thereby removed. The seeds of *Ricinus communis* form the subject of an examination by Mr. E. L. Boerner, showing them to contain, in addition to the fatty oil, emulsin, sugar, and a crystallizable body possessing none of the characters of an alkaloid.

In a paper read before the Pharmaceutical Society, Mr. H. Senier supplies some interesting information respecting the nature of the colouring matter contained in the petals of *Rosa gallica*. This substance appears to be an acid capable of forming well-defined crystallized salts with the alkali metals. The numbers obtained in an analysis of the lead salt lead to the formula $Pb_2 C_{21} H_{29} O_{30}$.

Emodin, one of the constituents of rhubarb, is now known to be also a constituent of the bark of *Rhamnus frangula.* Messrs. Liebermann and Waldstein, who have isolated this substance from a parcel of old bark, admit that it is not quite identical with the frangulic acid. or frangulin, obtained by Faust, and consider it probable that the latter may exist in the recent bark and become gradually converted into emodin by oxidation. Such a change, if confirmed, would throw light on the hitherto unexplained fact that this bark requires to be kept for at least twelve months before it is suitable for medicinal use (see *Year-Book of Pharmacy*, 1876, p. 162).

The presence of tannic acid in gentian root, first asserted by Mr. E. L. Patch, and subsequently disputed by Professor Maisch, is now confirmed by M. Ville, who finds that the colouring matter of gentian, known as gentianin, gives unmistakable reactions with ferric chloride, albumen, and gelatine. Gelseminic acid, one of the principles isolated from the root of *Gelsemium sempervirens* is proved by Professor Sonnenschein to be identical with æsculin, a substance contained in the bark of the horse chestnut. Benzoic and cinnamic acids are now stated to occur in balsam of tolu in the free state as well as in that of their benzylic ethers.

Professor Bentley draws attention to the distinguishing characters of valerian and the rhizome and rootlets of *Veratrum album*, on account of an admixture of the latter he has recently detected in a parcel of valerian. In a like manner, Mr. Holmes deals with the features of distinction between aconite root and the root of masterwort, *Imperatoria ostruthium*, which he has observed to occur as an adulterant or admixture in the former. Considering the cheapness of aconite root, Mr. Holmes attributes this adulteration to carelessness in collecting the drug, an opinion which receives much support from an article on masterwort published in the *Pharmaceutische Zeitung*, an abstract of which will be found on page 200 of this volume.

Notwithstanding all that has been said and written with reference to the syrups of phosphates of iron, this subject still continues to engage attention, as may be seen from the further contributions it has received during the current year. A ferric citrophosphate, of the formula $Fe_2.PO_4.C_6H_5O_7$, is described and recommended by Mr. Rother as superior, both as regards flavour and the stability of its solution, to all similar combinations now in use. Among the modern ferric preparations employed as therapeutic agents, a solution of a very basic oxychloride, known as "*ferrum dialysatum*," deserves to be mentioned here as one rapidly gaining favour with the medical profession on account of its non-astringency and ready assimilation in the system. Its history, mode of preparation, and properties form the subject of several papers contained in this volume. The process of dialysis will probably before long find a more extensive application in pharmacy than has hitherto been the case; for not only does it afford an easy and very simple means of separating crystallizable substances from gummy, extractive, colouring, and other colloid matters, but it may also serve, as Mr. Rother shows, for the concentration of solutions of crystalloids without the aid of heat, an important point considering the injurious influence of the latter on many vegetable alkaloids and other active principles.

The pharmacy of sugar receives able treatment at the hands of Dr. Symes in a paper read before the British Pharmaceutical Conference, in which he deals with the various objects for which sugar is used in pharmaceutical preparations, the condition in which it should be used, its inversion by acids, and other points of interest. Mr. E. Gregory criticises the various modes of preparing emulsions, and arrives at the conclusion that the use of mucilage in these processes should be abandoned in favour of powdered gum. For the preparation of extracts known to suffer in quality from the application of heat, Mr. A. Herrara suggests the abstraction of the greater part of the water from the expressed juice or cold infusion by repeated freezing, and the subsequent evaporation of the mother-liquor at a temperature not exceeding 30° C. Extract of conium thus prepared has the characteristic odour of conine, and when treated with water yields a solution possessing the appearance and all the properties of the fresh juice. A cold process of preparing essential oils, consisting mainly in their extraction by means of petroleum benzin, is described by Mr. L. Wolff, who states that oils obtained in this manner have an aroma superior in many cases to that of the same oils obtained by distillation.

Mr. B. Squire points out the ready solubility of crystallized nitrate of bismuth in glycerin, and recommends such a solution both for internal and external application. The chemical reactions of this glycerole induce Mr. J. Williams to regard it as a chemical combination, whereas Mr. W. Willmott, who has likewise studied its behaviour with reagents, believes it to be a mere solution. An oleate of bismuth containing twenty per cent of the oxide is suggested by Mr. S. C. Betty as a suitable external remedy. Mr. Squire also proposes the use of chrysophanic acid, one of the principles of rhubarb, in the place of goa powder, of which it forms the chief constituent. It is best applied in the form of ointments, formulæ for the preparation of which are given both by Mr. Squire and Mr. Gerrard. Mr. W. W. Urwick reports the interesting observation that an albuminated solution of phosphorus in a mixture of absolute alcohol and glycerin instantly loses its odour and taste on the addition of a few drops of oil of neroli, thus producing a pleasant and palatable mixture.

We cannot, in our opinion, more fitly conclude this introductory chapter than by drawing the attention of our readers to Mr. Schacht's account of his experience in the equipment and working of a small pharmaceutical laboratory. His lucid description, coupled as it is with excellent drawings by Mr. J. Thompson, will serve as a valuable guide to many a pharmacist engaged in the construction or improvement of a laboratory of his own, and as an inducement to many others, who previously might not have thought of so doing, to combine the work of the laboratory with the duties of the counter; a combination which, if judiciously carried out, can only result to their advantage. There are among the numerous preparations used in pharmacy many, the purity and strength of which cannot be ascertained by reliable tests; and with regard to those the pharmacist's best, if not his only, safeguard consists in their production by himself or under his own supervision. Nor can the education of the modern student of pharmacy be deemed sufficient unless his knowledge of dispensing and retail business be supplemented by a fair amount of practical experience concerning the processes of the pharmacopœia, and this, it need hardly be said, can only be acquired in the laboratory. In many respects Mr. Schacht's report appears to us a most valuable item in the pharmaceutical literature of the year, and as such we most heartily commend it to our readers.

PHARMACEUTICAL CHEMISTRY.

YEAR-BOOK OF PHARMACY.

PART I.

PHARMACEUTICAL CHEMISTRY.

The Detection of Arsenic in Poisoning Cases. J. A. Kaiser. (*Zeitschr. für Analyt.-Chem.*, xiv., 250–281.) The conversion of arsenic into chloride, and its separation as such from organic substances by distillation, is known as one of the best processes for the isolation and detection of this poison in forensic investigations. The author's method is a modification of this process, and consists mainly in the conversion of the distilling chloride into arsenic acid by means of free chlorine. The suspected substances are introduced into a large flask and mixed with a sufficient quantity of sulphuric acid previously diluted with one-third of its weight of water, to render the mixture fluid. The whole is allowed to stand for at least twelve hours, in order to effect the complete disintegration of the animal tissues. A quantity of fused sodium chloride is then added in large fragments, the flask connected with a smaller one in which are placed a few crystals of potassium chlorate, and this second flask in its turn connected with an absorption bulb containing water. Upon gently heating the contents of the large flask and continuing the application of heat until the fragments of sodium chloride have quite disappeared, chloride of arsenic distils over; and this, by the action of the chlorine evolved from the potassium chlorate, is converted into arsenic acid, which collects in the absorption bulb. The distillate may then be examined by Marsh's test or any of the usual methods. The author's report is a lengthy one, embodying minute details of all the operations involved. A blank experiment with the same quantities of the reagents to be employed is recommended, for ascertaining their absolute freedom from arsenic.

Determination of Phosphorus in Forensic Analyses. O. Schifferdecker. (*Zeitschr. des œsterr. Apoth.-Ver.*, 1876, 299.) The author has made a series of experiments with the view of ascertaining to what extent Mitscherlich's process for the detection of free phosphorus may be available for its quantitative estimation. He found that if the distillation be carried on to the complete termination of luminosity, about three-fourths of the phosphorus present will be found in the distillate. The contents of the receiver are treated with chlorine to convert the phosphorus into phosphoric acid, which is then precipitated by a mixture of magnesium sulphate, ammonium chloride, and ammonium hydrate. The precipitate, when washed, dried, and ignited, contains in 100 parts 46·2 parts of phosphorus.

Ergotinine. M. Tanret. (*Journal de Pharm.*, Sept., 1876.) Professor Dragendorff's statement that Tanret's ergotinine was not a chemically distinct substance, but a mixture owing its activity to the presence of sclererythrin (see *Year-Book of Pharmacy*, 1876, 98, 250), is contradicted by the author, who supplies the following evidence to show that his ergotinine cannot contain even a trace of sclererythrin. Sclererythrin is a red substance, forming with alcohol and ether solutions an intense reddish yellow colour. The least trace of it is sufficient to give, with dilute akalies, "a beautiful murexid colour." Ergotinine, however, is nearly colourless, and does not produce any coloration with alkalies. If an alkaline solution of sclererythrin is treated with an acid, and shaken with ether, the colouring matter passes into the ether. The contrary takes place with ergotinine; acids remove it from its solution in ether. The violet colour which sulphuric acid produces with scleroiodin cannot be confounded with that characteristic of ergotinine. Sulphuric acid alone strikes with the latter only a greenish blue. In order to develop the reddish yellow colour, followed by an intense violet blue (see *Year-Book of Pharmacy*, 1876, 98), it is necessary that the acid should not be too concentrated, but diluted with about one-eighth of water. Ergotinine is soluble in alcohol, chloroform, and ether, in which scleroiodin is insoluble.

The author regrets that Prof. Dragendorff has not given more explicit details as to the preparation and properties of the bodies represented by him as being the active principles of ergot, scleromucin, and sclerotic acid.

Ergotine. Prof. Buchheim. (From the *Klinische Wochenschrift; Pharm. Journ.*, 3rd series, vi., 4.) Like other investigators, the author has failed in his attempts to isolate the active principles of ergot. He has arrived at the conclusion that such an isolation is impossible, and that for practical medical purposes the infusion of ergot, or the freshly prepared extract, will alone remain available. The organization of the ergot fungus seems to him so low that its *mycelium* cannot build up organic matter, so as to constitute an alkaloid or glucoside substance, from water, carbonic acid, and ammonia, but feeds, so to speak, more directly on the vegetable material of the mother plant. He believes that less elementary compounds are taken up by it from the rye grain, and thinks the gluten the most likely material from which to form the gelatine-like substance which he isolated partly from ergotine. On this modified albuminous constituent of the rye, at a certain stage of its metamorphosis, he infers, depends the peculiar action of the fresh infusion or extract. Any further complex chemical processes and reactions for the isolation of the active substance must necessarily have changed it so much in its natural course of decomposition, that it has lost it efficacy; in the same manner, for instance, as the decomposing albuminous substances of putrid blood lose their poisonous effects when decomposition has reached a certain point. The freshly prepared ergotine seems therefore to give alone a guarantee of success. For subcutaneous application it ought to be carefully neutralized by carbonate of soda, as it contains much acid, especially lactic acid, as Buchheim found, besides quantities of leucine.

Amyrin, the Principal Constituent of Elemi. E. Buri. (*Neues Repert. Pharm.*, xxv., 193–204.) In his last reports on the chemistry of elemi, Prof. Flückiger mentioned that bryïodin of the formula $(C_{10}H_{16})_2 + 3H_2O$, constituted only a very small proportion of the crystallizable matter present in the resin, and assumed that the greater part consisted of amyrin of the formula $(C_{10}H_{16})_2 + H_2O$, which body the author has more fully investigated.

Amyrin is contained in elemi in the form of microscopic prisms, which can be separated from the other ingredients by treatment with cold alcohol, the former being insoluble in that liquid. By repeatedly recrystallizing the residue from hot alcohol, amyrin is obtained in colourless needles, joined together as globular aggregates of silky lustre. It melts at 177°, but resolidifies at a much lower temperature. Water does not dissolve it, but ether, chloroform, and carbon bisulphide dissolve it easily. Experiments have shown that 100 parts of alcohol dissolve 3·627 parts of amyrin at 10°. Concentrated sulphuric acid dissolves amyrin with a reddish colour. It is not attacked by melting potash. An alcoholic solution of amyrin rotates the plane of polarized light to the right.

The rotation in a layer 200 mm. long was equal to + 4·5° at 16°. Sp. gr. of the solution at 16° = 0·8255.

Amyrin is not volatilized in the vapour of water at the ordinary atmospheric pressure. When heated in a retort, it melts and decomposes, giving at 200° a yellow, thin, oily distillate, which becomes thicker as the temperature rises. The distillate afterwards solidifies; and at the end yellow clouds ascend, which condense in the neck of the retort to a yellow powder, leaving behind a shiny blistered cake. On heating a thin layer very carefully, amyrin sublimes in long thin needles; but the yield is only very small. Amyrin dried at 100° gave, by analysis, 81·31 to 83·77 per cent. carbon, and 11·39 to 11·81 hydrogen, agreeing nearly with the formula $C_{25}H_{42}O$, which requires 63·80 C, 11·73 H, and 4·47 O.

An atom of hydrogen in the molecule of amyrin can be replaced by the radical of acetic acid. One part of amyrin was heated with about four parts of acetic anhydride in a sealed tube to 150° for several hours, and the residue dissolved in hot alcohol and recrystallized, when acetyl-amyrin was obtained in white micaceous laminæ. It melts at 198°, and solidifies a few degrees lower. It is more difficultly soluble in alcohol then amyrin. At 18°, 100 parts of alcohol dissolve 0·473 part of acetyl-amyrin. Analysis gave 80·71 to 81·23 per cent. C, and 10·90 to 10·97 H, agreeing with the formula $C_{27}H_{44}O_2$, or $C_{25}H_{41}(C_2H_3O)O$, which requires 81 C, 11 H, and 8 O.

Bromine acts energetically on solid amyrin, forming a blackish green mass with strong evolution of hydrobromic acid. A cold saturated alcoholic solution of amyrin was treated with an excess of bromine, a yellow precipitate being deposited after several hours, which was recrystallized from hot alcohol. The purified product forms a colourless, indistinctly crystalline powder, which melts at 130° with decomposition. The analysis of this body gave 29·82 to 30·10 per cent. bromine, 59·58 to 59·67 carbon, and 7·95 to 8·17 hydrogen, numbers which may be represented approximately by either of the formulæ. $C_{40}H_{63}Br_3O$ and $C_{40}H_{65}Br_3O$; the former requiring 60·07 per cent. C, 7·89 H, 30·04 Br, and 2·00 O; the latter 59·63 C, 8·11 H, 29·96 Br, and 2·00 O. The formation of these compounds may be represented by the equations:—

$$8\,(C_{25}H_{42}O) + 30\,Br = 5\,(C_{40}H_{63}Br_3O) + 15\,HBr + 3\,H_2O;$$
$$8\,(C_{25}H_{42}O) + 20\,Br = 5\,(C_{40}H_{65}Br_3O) + 5\,HBr + 3\,H_2O.$$

Boiling nitric acid forms with amyrin a clear yellow solution, which after evaporation leaves a yellow mass. This mass gives an acid solution in water, as it contains oxalic acid. It reduces Fehling's solution when warmed. The greater part, however, is not soluble in water; it forms a resin acid, which when boiled with alcohol deposits, after cooling, a yellow powder. Dry hydrochloric gas does not act on amyrin alone, or dissolved in chloroform.

The destructive distillation of amyrin, yielded the following products:—

1. A fraction distilling at 60° – 70°. This formed a colourless liquid, lighter than water, almost tasteless, and with pleasant smell, and giving by analysis 83·13, and (2) 83·47 per cent. carbon, and 14·50 to 14·75 hydrogen.

2. A fraction distilling at 185° – 200° was a yellow thin liquid, sparingly soluble in water, with pleasant smell and aromatic taste, and giving by anyalsis 81·65 per cent., 11·47 H, and 6·58 O.

3. A fraction distilling at 260° – 280° was a golden yellow thick liquid, with slight smell and sharp taste, insoluble in water, and giving 84·40 C, 11·56 H, and 4·04 O.

4. Above 300°, a thick liquid with brown colour distilled over. The yellow powder observed at the end of the distilling operation consisted of three different bodies, which could not be separated and purified.

The comparison of amyrin with icacin, recently described by Stenhouse and Groves (*Lieb. Ann.*, clxxx., 253) as a body contained in the incense-tree, is worthy of notice, as Flückiger assumes it to be an elemi resin. It melts at 175°. Stenhouse and Groves give the formula $C_{46} H_{76} O$; but Flückiger thinks it probable that this body is similar to amyrin, and accordingly deduces from his analyses the formula $C_{45} H_{74} O = (C_5 H_8)_9 + H_2 O$. Icacin seems to replace amyrin in some kinds of elemi.

If Prof. Flückiger's formula be adopted, we obtain the following series of elemi constituents:—

Volatile Oil	$(C_5 H_8)_2$
Icacin	$(C_5 H_8)_9 + H_2 O$
Amyrin	$(C_5 H_8)_5 + H_2 O$
Bryoïdin	$(C_5 H_8)_4 + 3 H_2 O$

The Action of Dilute Nitric Acid on Brucine. W. A. Shenstone. (From a paper read before the Pharmaceutical Society, February 7th, 1877; *Pharm. Journ.*, 3rd series, vii., 652, 653.) The results of the author's experiments fully confirm those published last year by Mr. Cownley (*Year-Book of Pharmacy*, 1876, 28), and disprove Prof.

Sonnenschein's allegation that brucine can be converted into strychnine by the action of dilute nitric acid (*Year-Book of Pharmacy*, 1875, 22). It further appears from Shenstone's research that traces of strychnine are readily destroyed by the action of even very dilute nitric acid, and this fact probably explains why Prof. Sonnenschein failed to detect strychnine in the brucine experimented with. The destruction of strychnine by nitric acid, moreover, is an important point in forensic investigations.

Mr. Shenstone also gives a method of purifying brucine, which depends upon the fact that strychnine precipitates brucine from its salts, and consists in partially precipitating the brucine from its salts with an alkali, standing aside for a few hours, collecting, washing, and redissolving the precipitate in a dilute acid, then again partially precipitating, etc. The author found that the bruicne tested gave no indication of strychnine after four precipitations. The cost of this purification need be but slight, as the unprecipitated brucine can be recovered.

Note on Acetate of Morphine. M. Merck. (*Pharm. Zeitung*, 1876.) When freshly prepared acetate of morphine is easily and completely soluble in water; but it soon becomes less soluble, owing to a continual though slow elimination of acetic acid, which leads to the formation of a basic salt and eventually of pure morphine. It is further altered by long keeping, becoming yellow and even brown. The property of forming a colourless solution in cold, concentrated sulphuric acid belongs to the recently prepared salt only. After it has been kept for a few weeks it yields a faintly coloured solution, although the salt itself may still be perfectly white; and the longer it is kept the darker will be its solution in the acid. The best sample of commercial acetate of morphine will not dissolve without coloration in sulphuric acid.

Experience has shown that acetate of morphine undergoes no loss of its medicinal properties through the decomposition referred to, unless an intense yellow colour shows that the decomposition has proceeded too far. The author thinks that the test by means of sulphuric acid may be abandoned without disadvantage, and the more so as it may sometimes lead to the impression that narcotine is present.

Note on Capsaicin. J. C. Thresh. (From a paper read at the Pharmaceutical Society's meeting, December 6, 1876.) The author has succeeded in obtaining the active principle of capsicum fruit in a sufficiently pure state for an ultimate analysis. The process of purification consisted in dissolving the crude capsaicin in solution of potash (official strength), and precipitating by carbonic acid; collecting the precipitate, washing, drying, and dissolving in hot petroleum. After several days the principle crystallized out, and was washed, dissolved in alcohol, diluted with water, and left exposed to the air but excluded from dust until most of the alcohol had disappeared and the capsaicin had crystallized. This was collected, washed, and placed on the water bath until the weight was constant. The combustion of the substance thus purified was undertaken by Dr. Buri, in Professor Flückiger's laboratory, and gave the following results:—

1. Of the capsaicin dried over concentrated sulphuric acid, 0·2987 gram gave—

CO_2 . .	0·7713
H_2O . .	0·2486

2. 0·2860 gram yielded—

CO_2 . .	0·7363
H_2O . .	0·2347

From these results are calculated the following percentages:—

	I.	II.
C . .	70·42 . .	70·21
H .	9·25 . .	9·12
O . .	20·33 . .	20·67
	100·	100·

The simplest expression of the constitution of capsaicin is therefore most probably $C_9H_{14}O_2$, which formula agrees very well with the above results.

9 C . .	108 . .	70·13
14 H . .	14 . .	9·09
2 O . .	32 . .	20·78
		100·

Having since received a large supply of alcoholic extract of cayenne, Mr. Thresh hopes soon to have a sufficient quantity of the pure capsaicin to attempt the discovery of its relationship to other organic principles, and its structural formula.

Reports of the author's previous researches on capsaicin will be found in the *Year-Book of Pharmacy*, 1876, 250, 543.

Processes for the Detection of Alkaloids. Prof. G. Dragendorff. (From the *American Chemist*, April, 1876.)

The Strychnine and Brucine Process.

The substance to be analysed should be first cut into small pieces, and treated with water and a little sulphuric acid, enough to give a decidedly acid reaction to the mixture. To about 100 c.c. of the mixture of finely-cut substance and water, add 10 c.c. of diluted sulphuric acid (1·5). Digest at 50° C. for several hours, and then filter. Treat the undissolved material again with 100 c.c. of water and 10 c.c. of the dilute sulphuric acid in the same manner, and filter.

Put both filtrates together, and add sufficient calcined magnesia to neutralize most of the free acid; but the solution must retain a decidedly acid reaction. Evaporate on the water bath to the consistency of thin syrup, but not to dryness.

Mix this concentrated solution with three or four times its volume of alcohol, of from ninety to nine-five per cent., add a few drops of dilute sulphuric acid, digest at from 30° to 40° for twenty-four hours, and then filter off the insoluble matters. Evaporate the filtrate until all the alcohol has passed off, dilute the remaining solution to 50 c.c. in a flask, and shake it thoroughly with from 20 to 30 c.c. of pure benzol. Remove this benzol, and shake again with a fresh portion.

After the second portion of benzol has been removed, the watery solution is to be made decidedly alkaline with ammonia, warmed to 40° or 50°, when the alkaloid set free is taken up by shaking again thoroughly with from 20 to 30 c.c. of benzol. This is then removed, and the shaking is repeated with another portion of benzol.

The benzol solutions obtained in this way are generally colourless, and contain the alkaloids so nearly pure that, after shaking with distilled water and clearing by immersion in warm water, filtering and evaporating, a residue is obtained in which the alkaloids may be proved directly. But it is better, after the washing with distilled water, to take up the alkaloids again by shaking with water acidulated with sulphuric acid, treating twice with 20 or 30 c.c. of the acidulated water and removing the benzol, then saturate the watery solution obtained in this way with ammonia, and make a new solution of the alkaloids in benzol. Wash with pure water, filter, and evaporate; and if all the watery solution has been removed from the benzol, the alkaloids remain, in most cases, so pure and colourless that the identifying reactions may be obtained directly. It is best to divide the benzol solutions among several watch glasses, and evaporate at about 40° C.

The Complete Alkaloid Process.

1. The substance is digested as above, with water containing sulphuric acid, at a temperature between 40° and 50°, two or three times, and the filtrates are put together after all the liquid has been pressed out of the solid matter. Most of the alkaloids are not injured by this treatment, even when too much acid has been used. Solanine, colchicine, and digitalin are the only ones that might be injured by a large excess of acid. If there is abundance of time, the macerations may be made at common temperatures.

Berberine is less soluble in acidulated water than in pure water, but it is completely dissolved by the large quantity of liquid used. Piperine also dissolves with difficulty in acidulated water, and part of this alkaloid may remain in the undissolved residuum, where it should be sought for afterwards.

2. Evaporate the filtrates, after the free acid has been partially neutralized with magnesia, until the liquid reaches the consistency of syrup; mix this with three or four times its volume of alcohol and a little dilute sulphuric acid, allow it to digest for about twenty-four hours at about 30°, let it become quite cold, and filter from the solid matters that have been separated by the alcohol. Wash the solid residue with spirits of wine of about seventy per cent. The remarks made at 1 concerning solanine, colchicine, and digitalin, apply equally to this digestion.

3. The alcohol must be separated from the filtrate by distillation (evaporation), and the watery residue, after the addition of a little more water, if necessary, is filtered into a flask, and in its acid condition is treated with freshly rectified petroleum naphtha (see note at the end of this translation) by continued and repeated shaking together at a temperature of about 40°. After the liquids have separated, the naphtha, sometimes containing colouring matter and such impurities as may be removed by this treatment, is drawn off from the aqueous solution. The naphtha may also take up piperine, and if a considerable quantity has been used, and there is not much impurity present, the alkaloid will be left upon evaporating the naphtha in well-defined crystals belonging to the rhombic system. Concentrated sulphuric acid dissolves it gradually, with the production of a handsome brown colour.

4. Shake the aqueous solution with benzol, in the same way, at from 40° to 50°, and evaporate the benzol after removing it. If there are traces of any alkaloid in the residue from this evaporation, it indicates caffeine. In this case, neutralize the greater part of the

acid in the aqueous solution with magnesia or ammonia, but still leave it decidedly acid, and treat it again with fresh portions of benzol, until the latter leaves no residue upon evaporation. Wash the benzol solution by shaking it with distilled water; separate from the water, and filter it. Distil off the greater part of the benzol from this filtrate, and evaporate the remainder upon several watch glasses. Care must be exercised that in case a drop of the aqueous fluid passed through the filter it is not evaporated with the benzol.

The residue from this evaporation may contain caffeine, delphine, colchicine, cubebine, digitalin, and traces of veratrine, physostigmine, and berberine. Caffeine forms definite crystals, as colourless, glossy needles; it is known by its reaction with chlorine water and ammonia. Sulphuric acid does not colour it. Cubebine also forms small crystals, which may be known by their behaviour with sulphuric acid, and the same may be said of colocynthine, elaterine, and syringine. A yellow coloured residue indicates colchicine and berberine. Sulphuric acid dissolves and colours colchicine an intense and durable dark yellow; berberine olive green, becoming clear afterwards. Berberine may be distinguished from colchicine by the behaviour of its alcoholic solution with tincture of iodine. Delphine, digitalin, veratrine, and physostigmine are left as amorphous nearly colourless residues. Delphine is coloured light brown by sulphuric acid; digitalin yields with it, in less than fifteen hours, a number of colours, changing from amber, through red and brown, to dark cherry red, and its presence may be confirmed by the sulphuric acid and bromine reaction. Veratrine, with pure sulphuric acid, becomes yellow orange, and in less than half an hour beautiful orange red, and this test may be confirmed by boiling with fuming hydrochloric acid. Physostigmine is not coloured by sulphuric acid. It may be known by its action on the eyes of cats.

5. The acid watery liquid is shaken with amylic alcohol in the same way as in 3 and 4, if the presence of theobromine is suspected.

There are also taken up by the amylic acid some of the above-named alkaloids remaining from 3 and 4; namely, veratrine and berberine, and traces of narcotine, aconitine, and atropine, and they are left in crystals after the evaporation of the solution.

Theobromine is recognised by its reaction with chlorine water and ammonia, and also as it dissolves without colour in concentrated sulphuric acid.

Narcotine is not readily soluble in acetic acid, and may be recognised by its reaction when warmed with concentrated sulphuric acid.

6. The acid watery liquid is shaken with chloroform only when the presence of the alkaloids of opium is suspected.

Chloroform takes up papaverine, thebaine (slowly), together with small quantities of narceine, brucine, physostigmine, berberine, and, when the treatment given at 5, is omitted, veratrine and narcotine.

Crystals of papaverine and brucine are left after the evaporation of the chloroform solution. Papaverine may be readily distinguished by testing with sulphuric acid (beautiful blue violet colour), and brucine by the red colour imparted to it by Erdmann's reagent. Most of the narcotine, thebaine, narceine, veratrine, physostigmine, and berberine, are left as amorphous substances.

Narcotine may be separated from the other alkaloids by dilute acetic acid, in which it is not readily soluble, and it may be proved as in 5. Thebaine is characterized by its behaviour with cold sulphuric acid. Veratrine and physostigmine as above.

7. The watery liquid at about 43° is then covered with a layer of petroleum naphtha, made distinctly alkaline with ammonia, and immediately well shaken. After the first naphtha solution has been drawn off, other extractions should be made at the same temperature with fresh portions of petroleum naphtha. The warm naphtha solutions should be washed with distilled water and afterwards filtered and evaporated. If the solution is too highly coloured by foreign matter, it may be purified by taking up the alkaloids in acidulated water, adding ammonia and shaking with pure naphtha again.

The petroleum naphtha takes up strychnine, brucine, quinine, emetine, veratrine, conine, nicotine, and papaverine.

(*a*) Of these, conine and nicotine are fluids, and have characteristic odours. They may be brought into solution in distilled water, and nicotine is precipitated in minute crystals by potash-cadmium-iodide from the diluted solution after neutralizing with sulphuric acid, while conine is precipitated in amorphous form.

(*b*) Upon cooling the warm naphtha solution, quinine separates, and traces of strychnine and papaverine also crystallize out.

(*c*) After evaporation, the remainder of the quinine, strychnine, and papaverine are left in crystals, and brucine, emetine, and veratrine in amorphous form.

The dry alkaloids are treated with anhydrous ether, which dissolves quinine, emetine, papaverine, and veratrine; and also conine and nicotine, if they have not been removed by water.

Strychnine and brucine may be separated by absolute alcohol, in which strychnine is nearly insoluble. Brucine is recognised after the evaporation of its solution, by its behaviour with Erdmann's reagent. Strychnine may be determined by means of sulphuric acid and bichromate of potash.

After evaporating the ether solution, quinine, emetine, veratrine, and papaverine are dissolved in the smallest possible quantity of very dilute sulphuric acid; and the cold solution, which should not contain less than one per cent. of the alkaloids, is treated with carbonate of soda, when quinine, emetine, and papaverine are precipitated.

Quinine may be determined by its behaviour with chlorine water and ammonia. Emetine by producing an emetic effect, and by the absence of the veratrine reaction with hydrochloric acid. Papaverine by its behaviour with sulphuric acid. Veratrine, after its watery filtrate has been treated with chloroform and the latter evaporated by boiling, with hydrochloric acid.

8. The alkaline watery liquid is shaken with benzol at 40° or 50°, purifying as in 7. This removes quinidine, cinchonine, atropine, hyoscyamine, aconitine, physostigmine, and codeine.

Crystals of cinchonine, sometimes accompanied by a little atropine and quinidine, separate from the solution on cooling.

After evaporating the solution there remain with those just named, crystallized codeine (very distinct), aconitine, hyoscyamine, and physostigmine (mostly amorphous).

(*a*) The residue left by evaporation is treated with ether, which dissolves all the above-named alkaloids except cinchonine.

(*b*) The residue from the evaporation of this ether solution must be dissolved in the smallest possible quantity of water containing sulphuric acid, and treated with ammonia slightly in excess, which separates quinidine and aconitine, leaving atropine, hyoscyamine, and codeine in solution.

The precipitate, which may contain quinidine and aconitine, is collected on a very small filter and dissolved in the least quantity of hydrochloric acid. Upon the addition of chloride of platinum the whole of the quinidine is precipitated.

The solution of aconitine is freed from platinum by a current of sulphuretted hydrogen; then it is made alkaline and shaken with chloroform. In the residue left by evaporating this chloroform solution, the aconitine may be recognised by means of sulphuric or phosphoric acid.

(*c*) Atropine dissolves with difficulty in cold benzol, and codeine dissolves readily. The former is not coloured by concentrated sulphuric acid; the latter is gradually coloured blue. Atropine, when warmed with concentrated sulphuric acid, gives the characteristic odour previously described; codeine does not. Atropine (hyoscyamine) distends the pupil of the eye; codeine does not. For physostigmine, see 4.

9. The watery liquid is now acidulated with sulphuric acid and heated to 50° or 60°, covered with amylic alcohol, purifying as in 7 and 8. By shaking with amylic alcohol at the temperature just given, the morphine, solanine, and part of the narceine are obtained. The latter should be dissolved in lukewarm water, and put with the watery liquid at 10.

The solution of solanine in amylic alcohol gelatinizes upon cooling, that of morphine forms the best of alkaloid crystals. Morphine is proved by Fröhde's reaction (with molybdate of soda) and by Hersemann's test (concentrated sulphuric acid solution and nitric acid).

Solanine is characterized by its decomposition in hydrochloric acid, and the retention of the products of this decomposition by ether; and also by its behaviour with iodine water and sulphuric acid.

10. The watery liquid may still contain curarine and traces of berberine, narceine (and digitalin).

Evaporate it to dryness with powdered glass; digest the pulverized residue for a day in alcohol; filter, and evaporate the filtrate. If the residue is very impure, it may be repeatedly recrystallized from water and alcohol.

Berberine remains as a yellow coloured residue, and is known by the behaviour of its alcoholic solution with iodine water.

Narceine is left in colourless crystals. It is recognised by its reaction with sulphuric acid, or by the behaviour of its aqueous solution with iodine water.

Curarine is left mostly amorphous, and is distinguished by its reaction with sulphuric acid alone, and with sulphuric acid and chromate of potash.

NOTE.—Petroleum naphtha has a boiling point between 30° and 80°. It should be purified by shaking with an ammoniacal solution of acetate of lead, and distilling. That which is sold in Russia as an illuminating fluid, under the name of "chandorine," may be rectified for use in this way. Petroleum naphtha does not dissolve asphalt, which is soluble in benzol. Benzol boils at 80° or 81°. Petroleum naphtha begins to boil at a much lower temperature.

Preparation of Pure Caustic Potash. M. Pollacci. (*Zeitschr. des œsterr. Apoth.-Ver.*, 1876, 299.) Wöhler's process (heating one part of pure nitre with two parts of metallic copper) yields a preparation containing potassium nitrite as well as copper. The author obtains a purer preparation by using iron filings in place of the copper. The products of the decomposition are potassium oxide, ferric oxide, and nitrogen. The operation is conducted in an iron crucible.

The Pharmacopœia Test of Quinine Sulphate. Dr. B. H. Paul. (From a paper read before the Pharm. Soc., February 7, 1877.) The official test depends upon the fact that ether is capable of dissolving quinine freely, but cinchonidine and chinchonine sparingly. The proportion of ether in the Pharmacopœia is half a fluid ounce to 10 grains of the quinine sulphate, and the absence of any separation of alkaloid crystals after the addition of ammonia and ether is stated to be evidence of purity. This, however, is not the case. Upon mixing one decigram (0·1 gram) of cinchonidine sulphate with about 2 c.c. of ether, and adding ammonia sufficient to separate the base, the presence of the insoluble alkaloid becomes sufficiently distinct. But when the same quantity of cinchonidine salt is mixed with a large proportion of quinia, the result is different, and it appears that the presence of quinine increases the solubility of cinchonidine in ether, or at any rate prevents the latter from separating in a crystalline state. The author has applied the Pharmacopœia test to quinine sulphate, which he ascertained by other means to contain 10 per cent. of cinchonidine sulphate; but the mixture remained perfectly limpid, and any one applying the test would say that the salt was absolutely pure. The limit within which cinchonidine cannot be detected by this process in quinine is therefore much higher than has been heretofore supposed. Some authorities give this limit as ½ per cent., others as 2 and 3 per cent., but the writer is inclined to think that less than 10 per cent. cannot be detected. A mixture consisting of 0·5 gram of quinine sulphate and 0·05 gram (10 per cent.) of cinchonidine sulphate does not show a particle of crystallization. The quantity of ether recommended to be used in the B. P. is much in excess of what is needed. The author states that he has made many mixtures of the two salts, and that even the presence of 30 per cent. of cinchonidine might pass unnoticed. But even with much smaller quantities of ether it is impossible to rely on its use.

The plan which he has adopted for detecting the presence of cinchonidine is that of fractional crystallization, which he finds to give a speedy indication of its presence. About 30 grains of the alkaloid salt are put into a capsule, a fluid ounce and a half of water is added, and heat is applied until the salt is nearly dissolved.

The water is insufficient to dissolve it entirely; but when heated up to the boiling point, the greater part of the quinine sulphate is dissolved. Upon cooling, most of the latter is deposited, and the more soluble cinchonidine sulphate remains in solution. The liquid portion is then a saturated solution of quinine sulphate, together with any cinchonidine that may be present. By applying the test to that liquid, an indication may be got of cinchonidine, if present. This is a modification of the test which has been very much used on the Continent, known as Kerner's test, and the one adopted in the G. P. The latter consists in adding 20 c.c. of distilled water at 15° C., to 2 grams of the salt, briskly shaking, and filtering after thirty minutes at 15° C. Five c.c. of the filtrate are put into a test tube, and 7 c.c. of ammonia are poured carefully on the top. The tube is closed with the finger and gently reversed, when either immediately, or in a short time, the contents of the tube will form a perfectly limpid solution, if the salt was pure. This test is very reliable, and founded on very sound principles, which are these:—Quinine sulphate is sparingly, but cinchonidine sulphate readily, soluble in water, of which the former requires 750, the latter 100 parts; so that, putting these two facts together, a very good indication is obtained as to the presence or absence of cinchonidine. The defect attaching to this test lies in its application. If, for instance, a sample of quinine sulphate, or a mixture containing 1 per cent. of cinchonidine sulphate, be treated with cold water, and the cold filtrate be treated with an equal volume of ammonia (sp. gr. 0·920), the result is a perfectly clear solution. But when the same salt is boiled with water, and even when treating the cold liquid with ether, the cinchonidine will separate.

In an examination of nine samples of quinine sulphate, the author found cinchonidine present in all cases; varying in amount from 1 to 10 per cent.

Between these two extremes of 1 and 10 per cent. there is a very wide margin; and the author thinks that the circumstance that such quantities may be overlooked in testing quinine, is important both to manufacturers and to pharmacists, who are liable to be placed in circumstances of difficulty on account of this impurity. In the first place, a manufacturer who produced a pure article might be prejudiced, in tendering for contracts, by being placed in disadvantageous competition with other persons who offered quinine of the character mentioned, containing 10 per cent. of cinchonidine, a proportion amounting, at the present prices, to a difference of tenpence on the ounce, which is a large extra profit on the quinine.

The process employed by the author for the analysis of the nine samples was as follows:—Four or five grams of the dried salt were dissolved in 80 to 150 c.c. of boiling water; when cold the clear liquid was removed from the crystallized quinine sulphate, and shaken with ether so as to leave a distinct layer undissolved. On the addition of ammonia in excess, the alkaloid separated was in most cases only partially soluble in the ether; with the samples containing least cinchonidine, the whole of the alkaloid was at first dissolved by the ether, but after the lapse of a few hours the cinchonidine was deposited in the form of crystals, which were collected on a filter and weighed. The quinine sulphate, which separated on cooling the hot solution, was again treated as at first, and the mother-liquor again mixed with ether and ammonia. In this way a further quantity of alkaloid insoluble in a moderate proportion of ether was obtained; and by repeating the process a third time another small quantity was extracted. The samples were all dried at 212° F. in a weighing glass capable of being perfectly closed immediately on being removed from the steam bath. The results in all cases indicate the minimum quantity of cinchonidine which the process could indicate.

Sample.	Water of Crystallization.	Cinchonidine Sulphate.	
		Dry.	Equal to Crystallized.
1	15·05	7·98	9·19
2	15·51	7·51	8·64
3	14·90	4·22	4·86
4	15·04	5·92	6·81
5	14·20	·99	1·14
6	15·15	3·16	3·64
7	13·67	4·90	5·64
8	8·10	4·55	5·24
9	10·37	5·44	6·26

Examination of Some Commercial Samples of Citrate of Iron and Quinine. Dr. B. H. Paul. (*Pharm. Journ.*, 3rd series, vii., 829.) The British Pharmacopœia requires this preparation to contain 16 per cent. of dry quinine, and the application of the test, as generally performed, is more apt to yield figures in excess than below the true per centage, owing to the reluctance with which the precipitated quinine parts with its water. Dr. Paul examined three samples of the salt. The first was contained in a 1 oz. bottle, bearing the label of a wholesale druggist in London, with the name and address of the firm, and describing the preparation as "Citrate of Iron and Quinine, British Pharmacopœia." On testing this sample according to the official directions, it gave a precipitate amounting to 9·3 per cent., instead of 16 per cent., or a little more than one half of what it should have been. On testing this sample by another method, and carefully extracting the alkaloid by ether, the total amount of the dry alkaloid was 8·96 per cent. A further examination of this alkaloid showed that it was not entirely quinine, but that nearly one-fourth of it consisted of cinchonidine, with some amorphous alkaloid and cinchonine. The actual proportions were as follows:—

Quinine	6·80
Other alkaloids	2·16
	8·96

Sample No. 2 was also in a 1 oz. bottle, and bore a similar label and seal to No. 1. By the Pharmacopœia test this sample assayed 11·7 per cent. When tested with ether, the dry alkaloid extracted in this way amounted to 9·7 per cent., and on further examination of this alkaloid it proved to contain, as in the previous instance, other alkaloids besides quinine; the actual figures being as follows:—

Quinine	7·08
Other alkaloids	2·62
	9·70

Sample No. 3 was received in a paper package, and had already become somewhat damp. When tested by the Pharmcopœia method it gave a precipitate which in drying gave indications that it was not quinine. This precipitate amounted to 8·87 per cent. The alkaloids extracted from this sample by treatment with ether and thorough drying amounted to 6·96 per cent., and this consisted chiefly of amorphous alkaloids, namely:—

Quinine	1·60
Other alkaloids	5·36
	6·96

The fact that in two cases the preparations here referred to professed to be in accord with the requirements of the Pharmacopœia, renders these results especially noteworthy.

The Water of Crystallization in Quinine Sulphate. A. J. Cownley. (*Pharm. Journ.*, 3rd series, vii., 189.) Whilst the quantity of water of crystallization existing in freshly prepared and uneffloresced quinine sulphate is enveloped in some doubt, owing to the efflorescent character of this salt of quinine, and the question whether it contains 7 molecules of water according to Reynault, 7½ as given by Jobst and Hesse, or 8 molecules as stated by Schorlemmer, has still to be determined, it seems to be very generally stated that the anhydrous sulphate in only obtained at a temperature exceeding 120° C.

Jobst and Hesse, as quoted by Watts, state that at 110° to 120° C. the salt loses the whole of its water of crystallization: and the same temperature by Millon and Coumaille, as well as in Husemann's "Pflanzenstoffe" for 1870, with the additional statement that at 100° C. the sulphate contains 2 molecules of water. This latter view, and the opinion that the salt is then identical with the air-dried salt as regards hydration, seem to have been adopted as correctly representing the condition of quinine sulphate at that temperature.

The author's experiments show that quinine sulphate really becomes anhydrous at 100° C., and when freely exposed to the air in this condition it rapidly absorbs water until it has the composition of a sulphate with 2 molecules of water; but when the access of air is retarded, the water of crystallization is of a varying quantity, and bears no constant relation to the salt until 2 molecules have been absorbed; also that freshly prepared quinine sulphate probably does contain, as stated by Jobst and Hesse, 7½ molecules of water, and that the salt in this condition, when freely exposed to air, rapidly effloresces until it attains the composition of a sulphate with 2 H_2O.

Aricine and Allied Substances. O. Hesse. (*Journ. Chem. Soc.;* from *Liebig's Annalen*, clxxxi., 58.) The author reviews the experiments made by Pelletier and Coriol, in 1829, on a bark of doubtful cinchona nature, from which these chemists obtained a base crystallizing in white transparent crystals, soluble in alcohol and ether, insoluble in water, and capable of forming an acid and a neutral sulphate; also those by Leverköhn, who obtained from false calisaya bark (cinchona from Cusco) a gelatinous, apparently non-crystalline, sulphate of a base termed by Buchner *cusconine;* those by Manzini, who extracted from pale tenchina bark an alkaloid which he called *cinchovatine*, but which the author subsequently found to contain also cinchonine, and which was subsequently found by H. Bourchardat and Winckler to be identical with aricine; and finally those by David Howard, whose results the author considers to be due to his having obtained an impure *paricine* (containing cinchonine?).

The alkaloids of a Cusco bark obtained from De Vrij were extracted by the author in the ordinary way; the concentrated neutral sulphuric acid solution yielded crystals of cinchonidine sulphate, and then gelatinized to a mass of microscopic prisms of the same, containing a little quinine sulphate; the filtrate from these contained cinchonine and amorphous bases, from which nothing characteristic could be isolated. Other samples of Cusco bark yielded only cinchonidine and traces of amorphous bases; the author considers De Vrij's bark not to have been genuine Cusco bark. Another Cusco bark (*China de Cusco vera* of Wiggers), identical with that employed by Pelletier and Coriol, yielded cinchonine, a little cinchonidine, and amorphous bases, but no other crystallizable alkaloid.

Commercial "pale tenchina" bark, carefully examined and selected by Wiggers, yields no cinchovatine or aricine, but only cinchonine and traces of quinidine (the conchinine of the author) and amorphous bases. Other pale tenchina barks from France yielded cinchonidine also; but this bark appeared to contain an admixture of other varieties, although specimens could be readily picked out agreeing in all respects with the sample obtained from Wiggers.

Cinchovatine, prepared by Winckler and examined by the author, gave no blue fluorescence when dissolved in sulphuric acid; it formed fine white prisms, which gave numbers agreeing with those required for cinchonidine; it melted at 208° (not corrected), and gave the rotation $(\alpha)_d = -107{\cdot}25$, whilst pure cinchonidine melts at 205° (not corrected), and gives the rotation $(\alpha)_d = 106{\cdot}89$ under the same conditions. It gave a hydrochloride indicated by $C_{20}\,H_{24}\,N_2\,O.\,H\,Cl.\,H_2\,O$; a platinum salt, $C_{20}\,H_{24}\,N_2\,O.\,2\,H\,Cl.\,Pt\,Cl_4$; a sulphate $(C_{20}\,H_{24}\,N_2\,O)_2\,H_2\,S\,O_4$, anhydrous after drying in the air, and giving the rotation $(\alpha)_D = -172{\cdot}20$, whilst pure cinchonidine sulphate gave $(\alpha)_d = -172{\cdot}37$; and finally, the hydrochloride and the sulphate gave with phenol water compounds precisely resembling those obtained with cinchonidine.

Aricine sulphate of commerce consisted mainly of a sulphate forming, on recrystallization, a gelatinous mass of minute needles, together with some cinchonine and quinine sulphates and a trace of resinous matter insoluble in water. The base in these small crystals gave on analysis numbers agreeing with cinchonidine; it melted at 205°, and gave the rotation $(\alpha)_d = -107{\cdot}25$; the sulphate crystallized from a large bulk of water formed crystals containing $(C_{20}\,H_{24}\,N_2\,O)_2\,H_2\,S\,O_4.\,3\,H_2\,O$; with phenol water and Seignette salt it formed difficultly soluble compounds precisely agreeing in all respects with those from cinchonidine.

Hence the author concludes that the bodies described as aricine and cinchovatine are simply more or less pure cinchonidine, as is also a lævo-rotatory crystalline base extracted in 1873, by De Vrij, from Jamaica bark.

Oil of Parsley. E. von Gerichten. (*Ber. der deutsch. Chem.-Ges.*, ix., 258–260.) The oil examined by the author was supplied by Dr. Trommsdorff, who obtained from 15 kilos. of parsley fruit 90 grams by distillation, and 16 grams more by shaking the distillate with benzol. It commenced to boil at 160° C., nearly all the terpene having come over below 210°. Between 270° and 290° a heavy yellowish green, very refractive, uncrystallizable liquid was obtained, and above 300° C. several brown decomposition products. By repeated rectification of the first portion, the pure, colourless terpene was obtained, boiling between 160° and 164° C., and having an intense odour of parsley. Its specific gravity at 12° C. is ·865, and its rotation power for yellow light and a column of 100 mm. = −30·8°. Muriatic acid colours it gradually brown, and destroys the parsley odour. Terpin and solid chlorhydrates could not be obtained.

Apiol. E. von. Gerichten. (*Ber. der deutsch. Chem.-Ges.*, ix., 1477–1479.) Pure apiol, or parsley-camphor, forms long, white, brittle needles, melting at 30° and boiling at about 300°. On boiling it with alcoholic potash, it is converted into a body crystallizing in pearly, rhombic plates, melting at 53·5°, and containing, as a mean of three combustions, $C = 65·4$, $H = 5·5$. On boiling it with dilute nitric acid, it yields oxalic acid and a body crystallizing from alcohol in long, brilliant, yellow needles, melting at 114° and dissolving gradually in boiling potash with an intensely purple colour.

The Aloin of Barbadoes Aloes. Dr. E. Schmidt. (Abstracted from the *Archiv der Pharmacie*, v., No. 6, 1876; *Pharm. Journ.*, 3rd series, vii., 70.) Of the different processess which have been recommended for the preparation of aloin, the method proposed by Tilden (*Year-Book of Pharmacy*, 1870) was found to give the most satisfactory results. According to this method, the aloes crushed small is dissolved in nine or ten times its weight of boiling water acidified with sulphuric acid. After cooling and standing for a few hours, the clear liquid is decanted from the resin, and evaporated. The concentrated solution deposits a mass of yellow crystals, which can be purified by washing, pressure, and recrystallization from hot spirit. After several recrystallizations the aloin is obtained in the form of beautiful yellow needles, which are pretty soluble in water and in alcohol, but soluble with difficulty in ether.

The melting point was found to vary, according as the crystals contain water or not. The crystals melt between 70° and 80°, and the anhydrous substance at 146°–148° (Stenhouse 150°).

Aloin contains water of crystallization which it loses completely when left over sulphuric acid, or when dried at 100°. The quantity of water present, however, is by no means constant; for not only do different preparations differ from one another, but even the same material, according to the concentration and temperature of the solution from which it is deposited.

The air-dried substance heated to 100° lost in three experiments,—

I.	II.	III.
5·89	6·77	7·01 per cent. of water.

Another product lost under similar circumstances,—

IV.
11·93 per cent. of water.

In another case the first crop of crystals dried in the air, then at 100° lost,—

V.	VI.	VII.	VIII.
11·56	11·89	11·79	11·60;

whilst a subsequent deposit of crystals gave the following percentages:—

IX.	X.	XI.	XII.	XIII.
13·76	14·04	14·29	13·90	14·01

Some aloin exposed for a long time over sulphuric acid lost 13·44 per cent. of water, a loss which was not increased by afterwards heating it to 100°.

It appears from these results that aloin is capable of uniting with water of crystallization in several proportions, which depend upon the temperature and state of concentration of the solution from which it is obtained.

According to the formula $C_{15}H_{16}O_7$—

One molecule of water requires .	5·52 per cent.
Two molecules	10·46 ,,
Three molecules	14·91 ,,

With the formula $C_{16}H_{18}O_7$—

One molecule of water requires .	5·29 per cent.
Two molecules	10·11 ,,
Three molecules	14·44 ,,

It seems, therefore, that aloin may crystallize with either one, two, or three molecules of water.

This variation of the water agrees with the observations of Flückiger upon the aloin of Zanzibar aloes, a substance which, according to Tilden, is isomeric with the aloin of Barbadoes.

Liebelt made numerous combustions of the aloin dried at 100°, and the percentages of carbon and hydrogen obtained by him are as follows:—

	I.	II.	III.	IV.
C	58·68	58·30	58·41	58·33
H	5·73	5·71	5·71	5·47

	V.	VI.	VII.	VIII.
C	58·42	58·48	58·17	48·66
H	5·57	5·70	5·33	5·23

	IX.	X.	XI.	Mean.
C	58·66	58·33	58·71	58·46
H	5·81	5·84	5·69	5·61

With these data there is a choice between two empirical formulæ: $C_{15}H_{16}O_7$, which requires—

C 58·44
H 5·50,

and $C_{15}H_{17}O_7$, for which the percentages must be—

C 58·25
H 5·50.

Various considerations seem to indicate that the former of these two expressions should be adopted, especially as Von Sommaruga and Egger had obtained similar results with the aloin of Socotrine aloes.

Nevertheless this formula cannot be accepted. Soon after the publication of Liebelt's analytical results in the *Berichte der deutsch. Ges. zu Berlin* (November, 1875), the author became acquainted with the paper read by Dr. Tilden before the British Pharmaceutical Conference in August, 1875. In that paper the formula $C_{16}H_{18}O_7$ is proposed, on the basis of analytical results obtained with the aloin and with its chloro, bromo, and acetyl substitution derivatives. These results led the author to recrystallize the aloin in his possession, and to submit it again to analysis, this time drying it in a vacuum. The results showed that Liebelt's analyses had furnished somewhat too little carbon. The following numbers were obtained:—

	I.	II.	III.	IV.	Mean. (Schmidt).
C	59·31	59·45	58·96	59·19	59·23
H	5·39	5·63	6·08	5·34	5·61

The formula $C_{16}H_{18}O_7$ requires—

C	59·62 per cent.
H	5·59 ,,

This formula, therefore, seems to be established.

The author's results with the bromo and chloro derivatives, however, do not entirely agree with those described by Tilden. When an aqueous solution of aloin is mixed with excess of bromine water, a copious yellow precipitate is obtained, as long ago shown by Stenhouse. This yellow precipitate, dried and crystallized from alcohol, yields beautiful yellow needles. This compound, however, is not a homogeneous substance, for it seems to contain not only tribromaloin, which is the chief product, but also small quantities of compounds richer as well as poorer in bromine, which are very difficult to separate on account of their almost equal solubility. Although several preparations were made, especially by the introduction of aloin solution into excess of bromine water, and the composition of these specimens was not altered by repeated crystallization, the analytical results were found to agree sometimes with the formula $C_{15}{}^{H_{13}}_{Br_3}O_7$, sometimes with the formula $C_{16}{}^{H_{15}}_{Br_3}O_7$.

All these brominated compounds exhibit much greater stability than pure aloin. They crystallize readily from alcohol in golden needles, which are almost insoluble in water and ether. The melting point appears to be 190° to 191°. Bromaloin also contains water of crystallization.

The air-dried substance lost at 100° the following quantities per cent.:—

I.	II.	III.	IV.	V.
9·00	9·22	9·06	11·93	10·56

A variation in the amount of water is exhibited here, as in the case of pure aloin. The formula $C_{16}{}^{H_{15}}_{Br_3}O_7$, with $3H_2O$, requires 8·81 per cent. of water; with $4H_2O$ 11·41 per cent.

The substance dried at 100° gave when burnt with chromate of lead the following percentages of carbon and hydrogen. The bromine was determined by the method of Carius:—

	I.	II.	III.	IV.	V.
C	33·36	33·38	33·49	33·17	33·13
H	3·17	2·76	2·89	2·93	3·06
Br	43·31	43·38	43·60	43·63	43·76

	VI.	VII.	VIII.	IX.	X.	XI.
C	33·47	33·84	33·71	35·15	34·27	34·24
H	2·69	2·70	3·02	2·97	3·11	2·01
Br	43·47	43·22	—	41·14	43·08	—

The following percentages are required for the two formulæ referred to :—

	$C_{15}H_{13}Br_3O_7$	$C_{16}H_{15}Br_3O_7$
C	33·03	34·34
H	2·39	2·68
Br	44·03	42·93

The author has not been successful in producing from aloin a definite chlorinated product by the action of chlorine either in the gaseous form or in aqueous solution. But by the action of potassic chlorate and hydrochloric acid, according to Tilden's process, a yellow substance was obtained which crystallizes in beautiful needles. The analysis of this compound, however, led to numbers which vary still more than those obtained in the analysis of the corresponding brominated derivative. The percentages of chlorine obtained were as follows :—

I.	II.	III.	IV.	V.
23·02	24·47	25·67	25·55	26·83

The formula $C_{16}H_{15}Cl_3O_7$ requires 25·03 per cent.

The author finds that barbaloin when digested with nitric acid yields chrysammic, picric, oxalic, and carbonic acids.

The action of zinc dust when heated with aloin has already been observed by Graebe and Liebermann, who obtained a hydrocarbon which they believed to be anthracene. As, however, it is not clear which kind of aloin these chemists operated upon, the author has repeated the experiment with Barbadoes aloin, and finds that the hydrocarbon derived from this source is principally methyl-anthracene.

The melting point was 210°–212°. By oxidation with chromic acid dissolved in acetic acid it furnished anthracene mono-carbonic acid (melting point 281°) soluble in ammonia, also a small quantity of a body having the properties of anthraquinone. The melting point of this latter was, however, not constant (210° to 240°); and it may, therefore, be assumed that it consisted of a mixture of anthraquinone and methyl-anthraquinone. Whether this anthraquinone is a product of the decomposition of methyl-anthracene, or is formed by the direct oxidation of a small quantity of anthracene, cannot be at present determined. The quantity of methyl-anthracene obtainable from barbaloin is exceedingly small (about 1 part of the hydrocarbon from 200 of the aloin); so that the aloin can scarcely be regarded as a direct derivative of methyl-anthracene.

The Camphor of Inula Helenium. J. Kallen. (*Ber. der deutsch. Chem.-Ges.*, ix., 154–157.) The author has continued his researches on this subject. The inula camphor was obtained in the form of white crystals by distilling elecampane root with steam. On pressing the crystals between bibulous paper, and distilling the latter with water, a yellowish liquid, *alantol*, is obtained, having an aromatic taste and the odour of peppermint, and boiling near 200° C. Its composition is $C_{10}H_{16}O$.

The crystals remaining after pressing are repeatedly crystallized from dilute alcohol, when they form colourless prismatic needles, of a faint odour and taste, fusing at 66° C., and sublimate; readily soluble in alcohol and ether, but slightly in water. It is the anhydrid of a new acid (*alantsaure*), of the formula $C_{15}H_{20}O_2$; the acid is $C_{15}H_{22}O_3$, crystallizes in fine needles, fuses at 90°–91° C., and yields rather unstable crystallizable salts.

Tannin as a Test for the Purity of Water. H. Kämmerer. (*Journ. für Pract.-Chem.*, 1876, 322.) The application of tannin is recommended by the author for the detection of albuminoid and other animal organic matter in water. Any sample of water forming a precipitate or turbidity with a solution of tannin should be condemned as unfit for drinking. As some saline constituents of potable waters retard the precipitation of organic impurities by tannin, the mixture should be allowed to stand for twenty-four hours before a negative result is to be regarded as an indication of purity.

Creasote and Carbolic Acid. A. Grätzel. (*Archiv der Pharm.*, Feb., 1877; *New Remedies*, May, 1877.) Pure beechwood-tar creasote must have the following properties:—It is a colourless, at most light straw yellow oily liquid of sp. gr. 1·080, distilling unaltered between 200°–225° C. Exposure to light and air, even for months, should impart to it at most only a dark wine yellow, but never a red colour, which would be indicative of foreign matters. It must be entirely soluble in caustic alkali, and on adding water no oily hydrocarbons must be set free. These latter, if present, are very difficultly removable, and possess a very disagreeable odour. It is soluble in 80 parts of cold water, and in less of boiling water, but the excess separates on cooling. It is miscible with 50 per cent. of its volume of glycerin of sp. gr. 1·250.

REACTIONS OF CREASOTES AND CARBOLIC ACIDS.

A. *In Aqueous Solution.*

To 15 drops of the solution to be tested is added 1 drop of the reagent.

Reagents.	Beechwood-Tar Creasote.	Carbolic Acid.	English Creasote.
Ferric chloride (cryst.), dissolved in 10 parts water.	Blue on first contact, then brown; on standing, orange.	Permanently violet.	Blue on first contact, then olive green; finally dirty yellow.
On further addition of same.	Dark brown precipitate.	Permanently violet.	Light brown precipitate.
Ferric acetate, dry, in 10 parts of water.	Brown, then with a shade of violet; lastly brown precipitate.	Brown and clear solution.	Brown and clear solution.
Ferric sulphate, dry, in 20 parts of water.	Blue, then with a shade of violet; lastly brown precipitate.	Permanently violet.	Grass green on first contact; then yellow precipitate.
Plumbic nitrate in 10 parts of water.	Clear; no reaction.	Opalescence; on standing, small deposit.	Opalescence; on standing, small deposit.
Stannous chloride in 10 parts water.	White precipitate, soluble in excess of reagent.	Small precipitate, insoluble in excess of reagent.	Small precipitate, insoluble in excess of reagent.
Plumbic acetate, neutral, in 10 parts water.	White precipitate, soluble in excess.	Small precipitate, soluble in excess.	White precipitate, only partially soluble in excess.

B. 1 *Part Dissolved in* 10 *Parts of* 92 *per cent. Alcohol.*

Aqueous solution of ferric chloride with one drop of alcoholic solution.	Blue on first contact, then green.	Violet on first contact, then green.	Green on first contact, then fine azure blue.

C. *Carbolic Acid and Creasotes unmixed with any Solvents.*

Saturated alcoholic ferric solution with one drop.	Dirty violet.	Greenish yellow on first contact, then brown.	Green on first contact, then a light mud brown.
With several drops.	At once green.	At once green.	At once green.

Decomposition of Ammonium Salts in Aqueous Solutions by Salts of Potassium and Sodium. Dr. H. C. Dibbits. (*Zeitschr. für Analyt.-Chem.*, 1876, 245.) In a previous report (see *Year-Book of Pharmacy*, 1876, 112) the author has shown that aqueous solutions of the crystallized salts of ammonium part with ammonia upon boiling, and that the quantity of ammonia thus liberated varies considerably with the different ammonium compounds. He has now examined this behaviour of ammonium salts in solutions containing also various quantities of a potassium or sodium salt, in order to solve the problem whether or not a mutual decomposition takes place between the two. By dissolving, for instance, equivalent proportions of ammonium sulphate and potassium chloride, and determining the loss of ammonia during the boiling of this solution, he wished to ascertain whether this loss is equal to that occurring with ammonium sulphate, or to that occurring with ammonium chloride; or in other words, whether the two salts introduced continue to exist as such in the boiling solution, or whether they form ammonium chloride and potassium sulphate. The results prove that a decomposition takes place, but only a partial one; so that in the instance named, the boiling solution contains four salts, viz., ammonium chloride, ammonium sulphate, potassium chloride, and potassium sulphate. The salts experimented with were the sulphate, oxalate, and acetate of ammonium on the one hand, and the chlorides and nitrates of potassium and sodium on the other. The mutual decomposition increases with the quantity of chloride or nitrate (of K or Na) employed, but is never complete. In every case the boiling solution was found to contain four salts.

The Detection and Quantitative Determination of Free Sulphuric and Hydrochloric Acids in Vinegar, Lime and Lemon Juices, and Similar Liquids. O. Hehner. (From the *Analyst.*) As vinegar consists, except in the case of its being distilled, not merely of acetic acid and water, but always contains acetates or tartrates of potash and soda and chloride of sodium, it is obvious that sulphuric or hydrochloric acid, if added in small quantity, can no longer be considered to exist as such in vinegar, but that they decompose an equivalent quantity of acetate or tartrate. Whenever there is any undecomposed acetate or tartrate present in vinegar, no trace of any mineral acid can be present in the free state. As the organic salts of the alkalies are converted by incineration into the corresponding carbonates, it can safely be asserted that whenever the ash of a vinegar exhibits an alkaline reaction, free mineral acid cannot be present in the vinegar. A trace of mineral acid may have been added, but it then has become neutralized by the decomposition of the acetates or tartrates. We have thus the simplest possible qualitative test for free mineral acids in vinegar.

But whenever the ash is neutral, free mineral acid is most likely present. The quantity of this may be ascertained with accuracy by following the same principle. The process is as follows :—50 c.c. of the vinegar are mixed with 25 c.c. of decinormal soda solution, or with a sufficient quantity so that on evaporation and incineration an ash having an alkaline reaction is left ; the residue is dissolved in decinormal sulphuric acid corresponding to the soda solution, boiled to expel carbonic acid, filtered, the filter washed with water, the liquid reddened by litmus and neutralized by decinormal soda solution, the volume of which indicates directly the proportion of free mineral acid present,—100 c.c. of the standard solution corresponding to 0·49 gram of $H_2 S O_4$.

The same process is likewise applicable for the determination of free mineral acid in lime and lemon juice.

A Method of Detecting and Estimating Castor and other Fixed Oils in Copaiba. Dr. Muter. (From a paper read before the Society of Public Analysts. November 15th, 1876; the *Analyst*, November 30th, 1876.) Observing the close affinity between copaivic and pinic acids, the author suggests a process of analysis based upon the difference of solubility of the sodium soaps in a mixture of ether and alcohol. A mixture of five volumes of absolute ether and one volume of absolute alcohol has been recommended as a very good solvent for sodium pinate by M. Barfoëd, who states that sodium oleate is soluble in this menstruum only to the extent of 1 in 1000 (calculated for oleic acid).

The process employed by Dr. Muter is as follows :—3 to 4 grams of the sample are weighed into a clean dry flask, and saponified on the water bath with 50 c.c. of alcohol and a lump of caustic soda, weighing not less than 5 grams. When all is dissolved water is added, and the whole washed into a half-pint basin so as to nearly fill it, and evaporated to 100 c.c. over a low gas flame. Dilute sulphuric acid is then added till the whole just becomes permanently turbid, and then solution of caustic soda is dropped in till it just clears again. By this means a solution is obtained with the least possible excess of alkali, and with a good amount of sodium sulphate. The whole is now evaporated to *perfect dryness* on the water bath, stirring towards the end, so that the sulphate may mix with the soaps and produce an easily pulverulent residue. The residue is removed from the basin into a small, wide mouthed, stoppered bottle, treated with 70 c.c. of ether-alcohol, and well shaken up. As soon as it is fairly settled, the fluid is filtered off through a *quick* filter; and this is repeated with two successive quantities of 70 c.c., making 210 c.c. in all of the solvent used. The residue in the bottle and on the filter now consists of sodium oleate and sulphate if the balsam be impure, and of the latter only if pure, with a little trace of the insoluble resin soap already referred to. The contents of the bottle and filter are then dissolved in warm water, and after heating until all smell of ether is gone, the whole is boiled, freely acidulated with hydrochloric acid, and set to cool. If, when cold, nothing but a few specks of brown resin should rise to the surface, the balsam is pure; but if an oily layer be formed, it is adulterated, and the smell of the separated oleic acid will at once determine whether it is actually castor oil or not. In the case of the presence of oil, two grams of pure and dry white wax are added, and the whole heated till the wax melts with the oleic acid. On cooling, a solid cake is formed, which is detached from the side of the beaker, and the fluid below passed through a filter. The cake is once more melted in boiling water, cooled, detached, dried by gentle pressure in blotting paper, put into the water oven in a weighed platinum dish till dry, and then weighed, and the weight of the wax used deducted. The beaker, filter, rod, etc., used are if at all dirty dried, extracted with ether, and the residue left after evaporation weighed and added to the total.

The calculation is then performed as follows :—

1. To the weight in grams found, add ·20 for loss of oleic acid in solvent, and then say as 95 : 100 : : total oleic acid.

2. Calculate the percentage from the quantity taken, and from this deduct six per cent. for possible altered resin in the balsam. The error, owing to the correction, of course increases with the amount of oil present; but it is stated to be always an error in the direction of under-estimation, which is the great point for public analysts. When working on three to four grams, with an admixture of not over 25 per cent., the errors due to loss of oleic acid and insoluble resin soap are said to so nearly balance each other that any correction is unnecessary, and the actual amount of oleic acid found may be taken as correct within a per cent.

The Oil of Orris Root. Prof. F. A. Flückiger. (Abstract of a paper in the *Archiv der Pharmacie*, June, 1876; *Pharm. Journ.*, 3rd series, vii., 130.) Orris root owes its use during more than two thousand years chiefly to its fragrance, which curiously enough does not belong to the living root. Its slight and by no means aromatic smell is first developed into the agreeable perfume after drying, without doubt in consequence of changes of a chemical nature, concerning which at present our knowledge is deficient. When the dried rootstock is submitted to distillation with water, eventually there appears upon the water a crystalline, odorous matter which is justly prized in perfumery and is specially prepared by some of the larger distillers. But the yield is very small, only about 1 part per 1000 of the orris root used. The product is of a yellowish brown colour, of the consistency of a firm ointment, and possesses the characteristic odour of orris root.

Oil of orris has hitherto been studied by H. A. Vogel, and by Dumas. The latter in 1835 assigned to it the formula $C_8 H_8 O$ ($C_8 H_{16} O$ according to the modern notation).

By repeated recrystallizations from alcohol of a specimen of oil of orris prepared by Messrs. Herring & Co., the author obtained it, with the help of animal charcoal, in colourless crystalline scales, the form of which could not be decided. By this purification of the oil, or presumed stearoptene, the odour was concentrated in the mother-liquid, the crystals becoming more and more odourless, until finally they perfectly lost all aroma. An alcoholic solution of the crystals possessed no rotatory power, and energetically reddened litmus paper moistened with alcohol. After repeated recrystallizations the melting point reached 52° C.; a less pure preparation melted at some degrees lower temperature. Carbon bisulphide appears to be unsuitable for the removal of the perfume from orris root; the quantity of essential oil is exceedingly small, and this solvent removes with it a very soft resin, tannin, and probably also fatty matter.

The numbers obtained in the combustion of the crystals, viz., $C = 73{\cdot}96$, $H = 12{\cdot}26$, taken in conjunction with the previous observations, leave no doubt as to the nature of the presumed orris stearoptene: it is myristic acid, $C_{14} H_{28} O_2$.

After this point had been established it was easy to remove the fat acid from the crude product by digesting the alcoholic solution with anhydrous sodium carbonate or bicarbonate, and thus obtaining a soap solution from which the myristic acid is precipitated upon addition of a stronger acid and dilution with water. Upon heating the liquid to 60° C. it rises as an oily layer, which solidifies in a crystalline form at a temperature some degrees below 50° C. By repetition of this treatment the product may be easily brought to approximate and finally to attain the melting point of pure myristic acid, 54° C. The effect of the presence of the smallest quantity of the obstinately adhering volatile oil, or of a trace of lauric acid ($C_{12} H_{24} O_2$), melting at about 44° C., which may easily accompany the myristic acid, must be to lower the melting point.

The above observations upon the London oil were so far repeated with a sample of oil from Messrs. Schimmel & Co., of Leipzig, as was necessary to show the identity of the perfumes.

After these experiments upon the perfectly odourless myristic acid, the preparation remains saturated with a somewhat volatile oil. Upon digesting the crude product in a closed flask with lead oxide, the oil separates as a rather thick brownish fluid, which remains fluid at 10° C.

As the oil containing myristic acid is only obtained by the most careful distillation, in the proportion of about 1 in 1000, the quantity occurring in the root itself may be estimated as being much smaller still, possibly not amounting to 1 in 10,000. It may probably be included in the as yet uninvestigated class of so-called ferment oils, in that so far as is indicated by the smell it does not occur in the living root. The question arises, how the myristic acid, which can only with difficulty be distilled without decomposition, passes over with the oil. The explanation of this is to be sought in the phenomenon of diffusion. Rose oil is similarly accompanied by a stearoptene that it is difficult to volatilize by itself.

The occurrence of myristic acid in oil of orris is probably to be attributed to a fat which is present in the root, and is split up by the vapour of water. The quantity of this fat must be very small, since 300 grams of orris root powder exhausted with carbon bisulphide gave a soft perfumed resin, but neither free myristic acid nor neutral fat could be detected. The author also sought to ascertain whether free myristic acid was already present in the root. The carbon bisulphide extract was digested with sodium carbonate and alcohol, in order to obtain a solution of sodium resinate and myristate, from which the acid sought could be precipitated by acetic acid. If myristic acid were present, it would on prolonged digestion of the turbid acid liquid gradually rise to the top as an oily layer. This, however, did not take place even after several days; the brown resinate slowly sank to the bottom as a pulverulent mass, and the liquid became clear without yielding an oily layer.

Alkalimetric Titration of Magnesia, Phosphoric Acid, and Arsenic Acid. Prof. F. Stolba. (*Ber. der Böhm.-Ges. der Wissensch.*, 1876, v.) Magnesia, as well as phosphoric and arsenic acids, are frequently estimated by precipitation as phosphate or arseniate of ammonium and magnesium, and weighing the arseniate as such and the phosphate after ignition as pyrophosphate of magnesium.

In the place of this gravimetric process, the author recommends a volumetric one, requiring less time.

Freshly precipitated and properly washed phosphate, or arseniate of ammonium and magnesium, when suspended in water, imparts to the latter an alkaline reaction, as may be seen by the violet coloration produced on the addition of a few drops of tincture of cochineal. The degree of alkalinity may be determined by standard hydrochloric or sulphuric acid, as will be seen from the following equations:—

$$Mg. N H_4. P O_4 + 2 H Cl = N H_4 H_2 P O_4 + Mg Cl_2;$$

$$Mg. N H_4. As O_4 + 2 H Cl = N H_4 H_2 As O_4 + Mg Cl_2.$$

As 1 c.c. of normal acid thus corresponds to

0·020 gram of $Mg O$,
0·0355 ,, ,, $P_2 O_5$, and
0·0575 ,, ,, $As_2 O_5$,

the author recommends the application of deci-normal acid, especially as the reaction with carmine is sufficiently delicate for this purpose. Tincture of brazil wood can also be used as an indicator. The *modus operandi* is as follows:—

The precipitate, after being well washed with solution of ammonia and then with rectified spirit, until the alcoholic washings cease to be alkaline, is introduced, together with the filter, into a flask containing 100–200 c.c. of hot water, and well mixed with the latter by means of a glass rod or thick platinum wire. Decinormal hydrochloric acid is now slowly added from a burette in moderate excess, the mixture being continually stirred during the addition, and the excess of acid titrated with decinormal $Na H O$. The results are stated to be very satisfactory.

From a solution containing calcium as well as magnesium, the former is first precipitated by oxalate of ammonium in the presence of chloride of ammonium, and then the magnesium by phosphate of sodium and hydrate of ammonium, without previously removing the calcium precipitate by filtration. As the presence of oxalate of calcium does not interfere with the process, the mixed precipitates are treated in the same manner as already described.

Possibly lithium may be estimated by the same method.

Preparation of Platinum Black by means of Glycerin. R. Zdrawkowitch. (*Bull. Soc. Chim.* [2], xxv., 198.) Platinum black in a highly active condition can be obtained, according to the author, by adding 3 to 5 c.c. of solution of perchloride of platinum, drop by drop, to a boiling mixture of 15 c.c. of glycerin and 10 c.c. of solution of caustic potash of 1·08 sp. gr.

Note on Carvol. Prof. F. A. Flückiger. (Abstract of a paper read before the Berlin Chemical Society: *Pharm. Journ.*, from *Ber. der deutsch. Chem.-Ges.*, ix., 468.) Volckel, in 1840, pointed out that oil of cumin consisted of a hydrocarbon and a portion containing oxygen, to which Berzelius afterwards gave the name of carvol.

This body was more minutely examined by Schweizer, in 1841. He found that upon treatment with caustic potash, glacial acetic acid, or iodine, it undergoes a remarkable change; that it is specially soluble in potash, acquiring a very acrid taste, for which reason Schweizer designated the product carvacrol. When, in 1842, Claus prepared camphor creasote by boiling camphor with iodine, Schweizer at once recognised its analogy with carvacrol. In 1844 he also obtained this compound by similar treatment of oil of *Thuja occidentalis*. Since then the methods of obtaining this body—at present looked upon as oxycymol, but probably more correctly oxycymene—have been multiplied. Pott obtained it by melting potassium cymensulphonate with potassium hydrate, the cymene employed being prepared by the action of phosphorsulphide upon camphor. H. Müller melted caustic soda with sodium cymensulphonate with the same result, the cymene (cymol) having been obtained from the oil of ajowan fruit (*Amini copticum*, L. = *Ptychosis ajowan* and *P. coptica*, D. C.). It now appears probable that cymene can be obtained by suitable treatment from any of the essential oils having the composition $C_{10} H_{16}$, as well as from many, if not all, that differ, by the addition of O or $O H_2$, and the chemical identity of cymene from the most diverse sources may now be accepted; but the optical properties of this substance have hitherto only attracted the attention of Schiff and Guareschi. It remained to be seen whether cymene from other sources possessed, for instance, the same rotatory property as that prepared from cumin oil by Guareschi. The author thinks that this property will generally be found wanting in artificial cymenes, whether prepared synthetically or by reduction of $C_{10} H_{16}$, $C_{10} H_{16} O$, or $C_{10} H_{18} O$. Probably oxycymene is always without optic action; carvacrol prepared by the author from oil of cumin being without rotatory power. The author points out that oxycymene differs from carvol in being permanently coloured green by alcoholic perchloride of iron, refracting light strongly, not penetrating the cork so readily, and not giving the creaking noise peculiar to carvol and other thin volatile oils when rubbed against the side of a glass vessel.

Carvol is the only oil that, as noticed by Varrentrapp in 1849, combines directly with $S H_2$. The author has used a slight modification of Varrentrapp's method in testing whether carvol is as limited in its distribution in nature as the corresponding hydrocarbon, cymene or cymol. The oil to be tested is diluted with one-fourth its volume of alcohol (sp. gr. ·830), and then saturated with sulphuretted hydrogen. Upon the addition of only a little concentrated ammonia, or better still, absolute alcohol saturated with ammonia, it solidifies to a crystalline paste of carvol sulphydrate $(C_{10} H_{14} O)_2 S H_2$, or $C_{20} H_{30} O_2 S$. Pure carvol is not necessary to the obtaining of this product; it is yielded by both the crude and rectified cumin oil of commerce. If the crystallization does not take place immediately, it can be rapidly induced by the passage of a few bubbles of sulphuretted hydrogen. The crystals can be washed with cold alcohol, and after further purification by recrystallization, they have neither smell nor taste. They can be decomposed by gentle heating with alcoholic soda; and upon dilution with hot water pure carvol separates.

Carvol from cumin oil rotates the polarized beam strongly to the *right*, giving with a column of liquid 25 mm. long, in a Wild's polariscope, and with the sodium light, a deviation of not less than 15·6°. The hydrocarbon of cumin oil, carvene, is very strongly dextrogyre, to the extent of 26·8°, under the same conditions.

Bolley has stated, that in distilling oil of curcuma, he had found the portion passing over beetwen 230° and 250° C. to give the formula $C_{10} H_{14} O$, whilst its behaviour with sulphide of ammonicum pointed to its being an isomer with carvol. The author, however, failed to get from curcuma oil a product corresponding, either in boiling point or composition, with carvol; and four different portions, equally with the crude oil, failed to give the crystals $C_{20} H_{30} O_2 S$.

The author next examined oil of myrrh, which according to Rinkoldt's analysis agreed in composition with carvol. An oil prepared by him from good myrrh, under the conditions above-mentioned, rotated 15° to the *left*, and yielded no sulphuretted hydrogen compound. Further, its elementary analysis did not correspond with carvol. Herr Buri found in the crude oil, C = 84·70, H = 9·98 per cent.; and in the principal portion, distilling between 262° and 263°, C = 84·70, H = 10·26. The formula $C_{22} H_{32} O$ would require C = 84·62, H 10·25, O = 5·13.

Oils of the composition of $C_{10} H_{14} O$ have been reported with more or less probability as present in oil of nutmeg and eucalyptus oil. Gladstone has already shown that the elements of the first formed no combination with oil of nutmeg; and this the author confirms, and gives the same report of oil of mace, his experiments having been made with samples distilled by himself. Neither did he obtain carvol sulphydrate from a commercial eucalyptus oil.

Oil of dill fruit (*Anethum graveolens*) yielded to Gladstone a portion behaving like the carvol of cumin oil, and the chemical identity of the two oils has been established by Nietzki. The author finds it unnecessary to separate the carvol, as the crude oil gives an abundant yield of crystals, $C_{20} H_{30} O_2 S$. The carvols from the two oils also correspond in their optical properties. They do not differ more in smell than many sorts of turpentine oil, or oil of citron and oil of lemon.

The author examined a sample of oil of *Mentha crispa*, and found it to rotate 9·3° to the *left*. Treated with sulphuretted hydrogen, it gave the crystals $C_{20} H_{30} O_2 S$. The liquid portion, after separation of the alcohol and sulphuretted hydrogen by a gentle heat, amounted to about 70 per cent. of the crude oil, and showed a diminished rotatory power (7·0° to the left). The portion not acted upon by sulphuretted hydrogen gradually deposited crystals in the cold; and upon continuing the passage of sulphuretted hydrogen, adding a little ammonia, a thick oil separated, which, after washing, formed a vitreous mass ($C_{20} H_{30} S_3$, or $(C_{10} H_{14} S)_2 S H_2$), the hydrothion sulpho-carvol or thiocarvum first obtained by Varrentrapp from cumin oil carvol. This compound, so very rich in sulphur, has at first an agreeable spicy smell, but when purified is odourless. As the oil of *Mentha crispa* rotated the plane of polarization to the left, it would result that the carvol it contained would also have a lævogyre action, although chemically it was perfectly identical with carvol from cumin oil. The author had supposed that the rotatory powers of the two carvols might be equal, but exercised in opposite directions. Examined, however, under the same conditions as those before mentioned for cumin carvol, the crisped mint carvol showed a deviation to the *left* of about 9° only. It would be interesting to compare these two carvols still more closely, as the author thinks that that from crisped mint would probably also yield an oxycymene (carvacrol) without optical action, as well as other derivatives identical with those from cumin carvol.

The author has not met with carvol in any other case, although he has examined a large number of essential oils.

Hesperidin. E. Paterno and G. Briosi. (*Ber. der deutsch. Chem.-Ges.*, ix., 250–252.) From four thousand ripe oranges the authors obtained 180 grams of pure hesperidin. Their process for the preparation of this substance deviates but little from the one described in the *Year-Book of Pharmacy*, 1876, 153. It can also be obtained from the ripe fruit of *Citrus limonum* and *Citrus medica*.

Pure hesperidin fuses at 243°–245°. It is nearly insoluble in water, dilute acids, and ether; but freely soluble in alkalies and in aniline. From its alkaline solutions it is precipitated by acids, and from solutions in aniline by ether.

Hesperidin. E. Hoffmann. (*Ber. der deutsch. Chem.-Ges.*, ix., 685.) The composition of this glucoside is represented by the formula $C_{22} H_{26} O_{12}$. When treated with dilute acids it yields glucose and a substance named hesperetin, $C_{16} H_{14} O_6$, which is split up by caustic potash into phloroglucin, $C_6 H_6 O_3$, and hesperitic acid, $C_{10} H_{10} O_4$. The latter fuses at 225°, but begins to sublime before the fusing point is reached; when fused with caustic potash it yields protocatechuic and acetic acids. During its sublimation it is partially decomposed, with the formation of a body resembling vanillin. Neutral solutions of its salts, but not solutions of the free acid, produce a cinnamon brown precipitate with ferric chloride.

Hesperetin fuses at 223°. It forms white crystals, having a sweet taste and being insoluble in cold water, but soluble in alcohol and ether.

The Manufacture of Nitric Acid. H. Göbel. (*Dingl. polyt. Journ.*, ccxx., 238–245; *Journ. Chem. Soc.*, Sept., 1876, 332.) Proposals have been made and methods devised for the decomposition of the sodium nitrate (Chili saltpetre); so that instead of sulphuric acid, some other decomposing substance should be used, such as—besides leaving behind a valuable residue—shall afford a good yield of acid. The best of these are the following:—

(R. Wagner.)—Heating a mixture of alumina hydrate with sodium nitrate.

(J. Walz.)—Heating sodium nitrate with calcium carbonate and steam in retorts.

(Kühlman.)—Heating sodium nitrate with manganese chloride, etc.

All these proposed methods have simply remained proposals, none being found of sufficient merit as yet to replace the method by which nitre is decomposed with sulphuric acid.

However, the plant and apparatus used in the above universal method, have undergone from time to time considerable improvements. Thus the old deep, elliptical pans, with stoneware lids, etc., have been replaced by cast-iron cylinders, which are set up on their sides. These have been found to possess many advantages, as they require comparatively little fuel, are easily managed, and do not permit loss of gas at the joints, these being reduced to minimum (they are lined inside with fire-clay tiles, cemented with acid-proof cement).

Another improvement, now an old one, is the fractional distillation of the acid, by which means the production of a colourless concentrated acid was made possible.

Then the old-fashioned earthenware head-piece and pipes were replaced by glass tubes; so that the reaction, and procedure of the distillation could be observed, and the danger of frothing or boiling over reduced or removed.

In earlier times, the receivers, consisting of earthenware or stoneware vessels, were frequently cracked or broken, with loss of vapours or acid, or both. It was necessary to moderate the action very considerably to prevent overheating of these condensers; and this meant loss of time, labour, and a reduced yield. To avoid these evils, R. Wagner proposed the employment of a series of funnel-shaped earthenware bottles, through which system the acid vapours circulate, accompanied by a stream of water. The author considers it questionable if the cooling of the distillate was sufficiently attained by these means. Another plan to avoid the cracking of the receivers, was to allow the heated gases from the firing-up apparatus attached to the decomposing vessel to pass under the condensers, and so to warm them before escaping to the chimney.

In England a still greater improvement was made, viz., the addition of a stoneware worm and condenser, through which the gases passed from the decomposer before entering the receivers. This precaution prevented the breaking of the receivers, or at least greatly reduced it. The apparatus used by the author with great success for cooling the gases, consists simply of a straight glass tube, bent at both ends, which lies in constantly renewed water. One end of the tube is connected with the tube of the decomposition apparatus; the other with the first receiver. This simple arrangement has enabled the author to decompose (with fractional distillation) 250 kilos. of saltpetre in 36 hours; and with no fractional distillation, 300 kilos. in 36 hours.

Besides this, the receivers could be diminished in number from 9 to 3, most of the acid collecting in the first receiver. Also, it is thus easy to obtain very concentrated acid. Experiments showed that in a cylinder apparatus there were obtained in the first receiver 140 kilos. of acid of sp. gr. 1·53, temperature about 60°. In the second, 55 kilos. of acid of sp. gr. 1·49. In the last receiver, the acid had a sp. gr. of 1·32.

In six months only one cooling tube was broken. It is shown by numerical data given, that by this careful method of cooling, an increased production is obtained of 6·8 kilos. of acid of sp. gr. 1·33, per 100 kilos. of sodium nitrate.

At the end of the apparatus, *i.e.*, in connection with the last receiver, is placed a tower of earthenware tubes filled with coke soaked in concentrated sulphuric acid, by which means the nitrous gases, otherwise lost, are absorbed. In fact, the arrangement is simply a small Gay-Lussac's tower.

A useful table is given, showing the increase of density of nitric acid on cooling from any likely temperature to 15·5° C.

I. Temperature.	II. Increase on cooling to 15° in deg. Baumé.	I. Temperature.	II. Increase on cooling to 15° in deg. Baumé.	I. Temperature.	II. Increase on cooling to 15° in deg. Baumé.
45·0	3·65	35·0	2·10	25·0	0·90
44·5	3·56	34·5	1·98	24·5	0·80
44·0	3·48	34·0	1·92	24·0	0·76
43·5	3·40	33·5	1·85	23·5	0·72
43·0	3·32	33·0	1·79	23·0	0·67
42·5	3·23	32·5	1·73	22·5	0·63
42·0	3·15	32·0	1·67	22·0	0·59
41·5	3·08	31·5	1·62	21·5	0·55
41·0	3·00	31·0	1·56	21·0	0·52
40·5	2·92	30·5	1·50	20·5	0·48
40·0	2·85	30·0	1·45	20·0	0·45
39·5	2·73	29·5	1·34	19·5	0·36
39·0	2·65	29·0	1·29	19·0	0·33
38·5	2·58	28·5	1·23	18·5	0·29
38·0	2·50	28·0	1·18	18·0	0·25
37·5	2·43	27·5	1·13	17·5	0·20
37·0	2·36	27·0	1·08	17·0	0·13
36·5	2·29	26·5	1·03	16·5	0·07
36·0	2·23	26·0	0·99	16·0	0·05
35·5	2·16	25·5	0·94	15·5	0·02

Suppose, for example, an acid is examined and found to be of a specific gravity of 36° Baumé, and its temperature is 40°; if this be cooled to 15°, it will naturally become denser, and to the extent of 2·85° B., its density at 15° being 36 + 2·85 = 38·85° Baumé.

Determination of Nitric Acid by Indigo. R. Warington. (*Chem. News*, xxxv., 45–47, 57–59.) The author first describes the method employed by Boussingault, in which the nitrate is boiled with hydrochloric acid, and solution of indigo added till a sap-green colour is permanently obtained. Boussingault destroys organic matter, when present, by a preliminary distillation with peroxide of manganese and sulphuric acid. The experiments made by the author with the method introduced by Marx, and since improved by Trommsdorff, Goppelsrœder, Bemmelen, and Sutton, are next detailed. In this method the reaction is brought about by mixture with oil of vitriol, without the use of artificial heat. The indigo employed was a solution of "indigo-carmine" (sulphindigotate of sodium); the solution of pure nitre contained 0·01011 gram in 10 c.c.; the oil of vitriol was distilled acid.

The author found:—

1. That the maximum amount of indigo is consumed only when a sufficiency of indigo is present with the nitrate before the addition of oil of vitriol. The plan adopted by Marx of mixing the nitrate solution with twice its volume of oil of vitriol, and then immediately running in the indigo, always consumes less indigo than the nitrate is capable of oxidising. The full amount of indigo can only be ascertained by a series of approximating experiments, in which the oil of vitriol is suddenly added to the previously mixed nitrate and indigo.

2. The amount of indigo required depends greatly on the proportion of sulphuric acid present, and within certain wide limits the amount of indigo is less as the proportion of sulphuric acid is greater. With 10 c.c. of nitre solution, 11·3 c.c. of indigo were required when the indigo and nitre were mixed with their own volume of oil of vitriol; but 8·9 c.c. of indigo were sufficient when two volumes of oil of vitriol were employed.

3. The full amount of indigo is consumed only when the temperature of the mixture remains sufficiently high during the reaction: 100°, 110°, and 120°, are given by various writers as the minimum temperature. When the reaction was immediate, artificial heat was found necessary; but when—through dilution of the nitrate, small volume of the liquid, weakness of the vitriol, etc.—the reaction was tardy, the temperature of the flask containing the mixture must be maintained by a paraffin or chloride of calcium bath, or the results will be too low.

4. The true tint of final reaction is a dull brown, which precede the commencement of green; the brown tint becomes green when suddenly diluted with water. If a solution of sublimed indigotine in sulphuric acid is employed, the tint passes at once from gold to green without an intermediate brown stage.

5. When a nitrate solution is diluted, it apparently requires distinctly less indigo per unit of nitrate if a double volume of oil of vitriol be employed; but if a single volume is used, the difference is very slight, and in the contrary direction. If two volumes of sulphuric acid are employed, the indigo must therefore be standardized with nitre solutions of several dilutions, to ascertain the value of different parts of the scale.

6. The influence of chlorides is slightly to diminish the indigo

required. With ·03 to ·10 gram of chloride of sodium in 10 c.c. of nitre solution, the reducing effect of 100 chloride of sodium was equal to 1·16 nitre. With much chloride the final tint is a bright green.

7. Some kinds of organic matter have a powerful reducing action. Cane-sugar had a greater effect the larger the proportion of sulphuric acid and the more dilute the nitrate; with a one-tenth nitre solution, and a double volume of oil of vitriol, 100 of sugar had a reducing effect equal to 62·3 nitre. The soluble humic matter of soils was apparently without influence,—determinations of nitrate in a kitchen garden soil by the mercury method, and by the indigo method, giving accordant results. Only one volume of sulphuric acid was used in this experiment.

Volumetric Estimation of Bismuth. M. M. Pattison Muir. (Abstract of a paper read before the Chemical Society: *Journ. Chem. Soc.*, 1876, 483.) The process described by the author depends upon the facts concerning the formation of chromate of bismuth made known by Löwe (*Journ. Prakt.-Chem.*, lxvii., 288 and 463). Potassium chromate or potassium dichromate solution is run into a nearly neutral solution of bismuth nitrate until the whole of the metal is precipitated in the form of chromate. The final point of the reaction is determined by bringing a drop of the supernatant yellow liquid into contact with a drop of the silver nitrate solution upon a white slab, when red silver chromate is produced.

On account of the uncertainty which still exists in reference to the exact composition of the chromates of bismuth, and also on account of the fact that a slight excess of either of the potassium chromates appears necessary in order to cause the complete precipitation of the bismuth salts, no attempt was made to calculate the exact quantity of chromate needed to precipitate a known weight of bismuth, and upon such a calculation to base the composition of a standard liquid; but the plan was adopted of titrating a dilute chromate solution against a standard bismuth solution, and from these results calculating the strength of the chromate in terms of bismuth precipitated.

The author first describes the results of the experiments made with a solution of potassium chromate. The chromate was purified by recrystallization from aqueous solution. About 10 grams were dissolved in 1000 c.c of water. A solution of bismuth nitrate was prepared by dissolving a known weight of pure bismuthic trioxide ($Bi_2 O_3$) in dilute nitric acid, and making up the liquid to 1 litre. The chromate solution was run into a measured quantity of the bismuth containing liquid (made nearly neutral with ammonia and maintained at the boiling point) until a faint reddish colour was produced on bringing a drop of the supernatant liquid in contact with a drop of an aqueous solution of silver nitrate spotted upon a glass plate which rested upon a sheet of white paper.

Partial neutralization of the acid liquid containing bismuth was effected by dropping in ammonia until a very faint precipitate was formed, then boiling the liquid, and continuing to add ammonia very carefully until the solution was but slightly acid. Before this point was reached, a precipitate invariably formed; but it was found that this did not interfere with the results. If an excess of ammonia were inadvertently added it was found better to add nitric acid in quantity sufficient to dissolve the precipitate, and again to nearly neutralize with ammonia, rather than to add merely such a quantity of nitric acid as should cause but a faint acid reaction in the liquid. The chromate was run in from a burette graduated in tenths of a cubic centimetre and furnished with a glass stop-cock. After the addition of a few drops of chromate solution, the liquid was boiled for some minutes and the precipitate was then allowed to settle; which it did very rapidly and completely. In order to bring a drop of silver nitrate solution on to the glass plate and at the same time to prevent the continued exposure of this solution to the air of the laboratory,—an exposure which always resulted sooner or later in the production of silver sulphide in the solution,—a special apparatus was made use of, by which the formation of silver sulphide was reduced to a minimum. The formation of silver chromate only became apparent after a few moments, and when an excess of silver nitrate was used relatively to the quantity of potassium chromate in the drop of liquid.

Two series of experiments were performed: one with potassium chromate, the other with the dichromate. The dichromate method proved to be the better one of the two, and yielded very satisfactory results. The dichromate, moreover, is more easily purified by recrystallization than the chromate. The reaction with silver nitrate is more marked than in the case of the chromate, but a slight excess of silver nitrate should here also be added, and a little time should be allowed to elapse before a conclusion is drawn as to the completion of the process. The difference between the quantities of bismuth taken and the quantities found are smaller in the results obtained by the dichromate than in those obtained by the chromate method. It is necessary to neutralize the greater part of the free nitric acid before running in the dichromate liquid.

No definite results could be obtained in the presence of chlorides, as the precipitate then formed was totally unlike the chromate of bismuth usually obtained; it was white or light yellow, heavy, and granular, and consisted probably to a large extent of oxychloride. As this process is not applicable in the presence of other metals, such as copper, arsenic, and calcium, such metals—if existing in solution along with bismuth—must first be removed by the ordinary method. This being done, the bismuth may then be titrated with perfect accuracy.

Preparation of Lithium Carbonate from Lepidolite. F. Filsinger. (*Archiv der Pharm.*, v., 198.) The lepidolite, reduced to fine powder, is treated with strong sulphuric acid, containing some nitric acid, in a large brick trough, at a gentle heat. It is heated with constant stirring till it gains consistency enough to be made into balls, which can be easily introduced into a reverberatory furnace. The slight excess of sulphuric acid is driven off at a gentle heat; the temperature then raised, and the pieces whilst still hot are treated with water in vessels lined with lead. The residue consists of almost pure silica, for which a market is easily found. As lithium does not replace potassium in alum, a sufficient quantity of potash is added to transform all the sulphate of aluminium present into alum. On evaporation the alum separates in powder. It is removed, dried in a centrifugal machine, and on recrystallization is obtained in fine crystals. The excess of alumina is precipitated from the mother-liquor by milk of lime, and the excess of sulphuric acid by barium chloride. The barium sulphate obtained is a marketable article. The liquid is then evaporated, and the mixed chlorides of lithium, potassium, sodium, calcium and sometimes barium, exhausted with absolute alcohol. The lithium and calcium chlorides are dissolved. The calcium is separated as oxalate, and the lithium chloride evaporated and crystallized. It is precipitated with ammonium carbonate and ammonia, and brought into the market in the form of carbonate. The advantages of this process are, complete consumption of the crude material, cheap reagents, common plant, precipitates which are easily washed, and a number of marketable chemicals, *e.g.*, silica, alumina, potash, alum, and lithium carbonate.

Constituents of Black Pepper. Prof. R. Buchheim. (*New Remedies*, September, 1876.) Several years ago the author has shown that black pepper contains two substances which are of analogous chemical constitution, and have a similar action. (*Archiv für Pathol.-Anatomie*, lvi., 9.) One of these is piperin, which was discovered by Oerstedt in 1819, and was first supposed to be the acrid principle, until Pelletier (1821) showed that it was tasteless when quite pure, and that the biting taste resided in the accompanying resin. To settle this question, Professor Buchheim lately exhausted 2000 grams of black pepper with alcohol, removed the alcohol from the percolate by distillation, and treated the residue with water, which dissolved only traces thereof, without assuming any sharp taste. The extract was now shaken with ether as long as the latter became coloured thereby. The residuary part of the extract consisted almost wholly of impure piperin, which was deprived of a little adhering resin by potassa solution, then dissolved in hot alcohol, decolorized by animal charcoal, and recrystallized from hot alcohol and petroleum ether. The pure piperin thus obtained consists of almost colourless rhombic cylinders, with a faint yellowish tint, which could not be removed. They were tasteless when merely placed upon the tongue, being entirely insoluble in aqueous fluids; but exhibited the sharp taste of pepper when chewed, or when introduced in alcoholic solution.

The ethereal solution obtained above was then shaken with solution of potassa, which removed chlorophyll, fatty acids, and an acid resin. On distilling off the ether a residue of an intense yellow colour was left behind, which was dissolved in alcohol and treated with animal charcoal. It was, however, impossible to decolorize it entirely; and, besides, a little piperin accompanied it, from which it was exceedingly difficult to separate it. In this condition the residue appeared as a yellowish brown mass of the consistence of thick turpentine, and of extremely biting taste. The yield was about two-thirds that of piperin. Treatment with alcoholic potassa and supersaturation with sulphuric acid, produced from it a substance which was recognised as piperidin sulphate.

There exist, therefore, in black pepper, two bodies, which yield piperidin with alcoholic potassa; namely, *piperin*, and the new body here obtained, for which the name *chavicin* is proposed, from *Chavica officinarum*, Mign., or long pepper. On account of its amorphous condition, this substance has heretofore been denoted merely as "resin," and had not been investigated. While *piperin* may be regarded as piperidin, $C_5 H_{10} H N$, in which one H is replaced by piperic acid—$C_5 H_{10} (C_{12} H_9 O_3) N$—we may consider *chavicin* in a similar manner as piperidin, in which one H is replaced by *chavicic* acid.

These piperidin compounds exist in nature, also, in other plants. Pellitory (*radix pyrethri*) contains a body which Professor Buchheim has named *pyrethrin*, and which he ascertained to be decomposable into piperidin and pyrethric acid. *Herba spilanthis* (from *Spilanthes oleracea*, Jacq., paracress) also contains a body which may be split up into an acid and piperidin.

Peptone. (From *New Remedies*, August, 1876.) The term "Peptone" is used to denote those albumen or proteïn-bodies which have been altered by the gastric juice, or in other words, the result of the action of pepsin upon fibrin or albumen. Peptones introduced into the digestive organs are directly absorbed into the blood, without having to undergo previous digestion, and are converted into albumen-bodies. As there are various diseases in which the secretion of normal gastric juice is more or less diminished, or entirely suppressed,—preventing, therefore, the assimilation of the proteïn compounds,—the nutrition of the system may still be accomplished by introducing peptones into the digestive canal. The importance of this mode of administering nourishment in typhous and gastric diseases is fully recognised by physicians.

The German peptone is sold in round tin cans weighing 340 grams (12 oz. avoird.), and containing 250 grams (9 oz. avoird.) of material. Dr. Hermann Hager suggests the following method of examining it: 10 volumes of the peptone are slightly warmed, mixed in a large test tube with 60 volumes of a concentrated solution of sodium chloride, and the mixture set aside. After the lapse of thirty minutes the peptone has collected at the bottom of the liquid, and occupies 8 to 9 volumes; after thirty minutes more 7 to 8 volumes; and after twelve hours not less than 3·3 volumes. Peptone in a thin layer is a clear liquid of the consistence of thin syrup, and has a faintly bitter taste, somewhat resembling that of extract of beef or of mushrooms. A peptone-chocolate is also manufactured; this is of dark brown colour, has the consistence of a soft extract, and is sold in the same kind of tin boxes as the peptone itself.

Hager quotes the following extract from a report of Dr. H. Sanders, in Amsterdam (who is also a manufacturer of peptone): "It is well known that the albuminoid substances are the most important nourishing agents of the animal body. From them the muscles and nerves draw the necessary material for their constant reconstruction during the process of life. But before these albuminoids can become of any use to the body, they must be digested; and this is done by being converted into peptone in the stomach and intestinal canal. As peptone it is taken up by the blood, and there reconverted into albumen. As soon as any peptone has been formed it is very rapidly absorbed. Whenever digestion is defective, or the gastric juice is of abnormal character, it is readily understood that the conversion of albumen or fibrin into peptone, and hence nutrition in general, must become impaired.

"This defect may be removed by introducing ready-made peptone, which is rapidly and completely absorbed by the body, and which requires no further digestion. For this reason it is just as effective if administered by the rectum as if introduced into the stomach; and in many cases the former way is alone practicable.

"The only disagreeable point about peptone is its taste, and if given by the mouth this may require correction. In the case of nursing infants, it is sufficient to add it to the milk, about one or two tablespoonfuls to the quart. By beginning with small quantities, say one teaspoonful, they become easily accustomed to it. Adults may take it in milk, or diluted with water, or beef tea; or it may be mixed with equal parts of sherry, madeira, or some other generous wine. The most agreeable mode of administration, however, is the following:—

"*Peptone Chocolate.*—250 grams (9 oz. avoird.) of peptone are gently heated, and 200 grams (7 oz.) of white sugar dissolved in it; to the warm solution are added, under constant stirring, 100 to 125 grams ($3\frac{1}{2}$ to $4\frac{1}{4}$ oz.) of pure pulverized chocolate (free from oil), until there is produced a homogeneous syrupy mass, which may be flavoured with vanilla, essence of orange or of lemons. On cooling this mixture may be kept for a long time without spoiling, and a portion may be dissolved in hot water or milk. When administering it per rectum it should be diluted with four to six parts of warm water."

Expulsion of Sulphuretted Hydrogen from its Solutions by Boiling. J. Volhard. (*Zeitschr. für Analyt.-Chem.*, 1876, 341.) It appears from the author's experiments that sulphuretted hydrogen cannot be completely expelled from its aqueous solution, even by long continued boiling. After boiling the solution in a flask for five hours, during which the water lost by evaporation was gradually replaced, the resulting liquid still contained 0·003 per mille of H_2S. Solutions which were boiled down to one-tenth of their original volumes yielded residues containing 0·0015–0·0016 per mille of the gas.

The Colouring Matter in the Petals of Rosa Gallica. H. Senier. (From a paper read at the Pharmaceutical Society's meeting, February 1st, 1877.)

Extraction.—The dried petals of commerce were first digested with ether, and the ethereal solution removed by filtration. By this treatment quercitrin—the yellow colouring matter—and solid fat were removed (Filhol). Experiments were next made to ascertain the relative value, as solvents of the colouring matter, of chloroform, water, and alcohol. No colouring matter was dissolved by the chloroform. Hot water dissolved it freely, but dissolved also much albuminous matter. Alcohol was found decidedly the best, yielding a solution comparatively free from other substances. But while the solution in water is of a bright red colour, that in alcohol is at first colourless—due most likely to some reducing action of the alcohol—but acquires in time a red tint, which brightens with age. From this alcoholic solution the colouring matter was precipitated in a green amorphous state by acetate of lead. This precipitate, after washing and drying (100° C.), was treated in two ways:—Firstly, the precipitate, suspended in rectified spirit, was decomposed by sulphuretted hydrogen, and the mixture filtered (Elsner). Secondly, the precipitate, suspended in rectified spirit, was decomposed by dilute sulphuric acid,—taking care to have the precipitate in excess,—and the mixture filtered. Both these latter solutions have a bright red colour. The solution obtained by means of dilute sulphuric acid was found to be the purer, though most of the reactions detailed below may be obtained from either, or even from the original alcoholic solution.

Action of Reagents.—Dilute *acids* deepen the colour; but concentrated they decompose it, concentrated nitric yielding a yellow solution. Alkalies change the colour from bright red to a deep red with a bright green fluorescence, and when added in excess give a yellow solution. A drop of solution of *soda* and a drop of the solution of colouring matter, placed on a glass slide and slowly evaporated by a gentle heat, yield under the microscope a mass of well-defined crystals. Potash yields crystals when treated in the same manner. Ammonia itself does not give crystals, but combined with soda it does. With potash, ammonia gives with the colouring matter perfect octahedra. These crystals under the microscope, if treated with an acid, yield the colouring matter in the red form, which evidently arises from the crystals not from the solution, thus showing that they are actual combinations of the colouring matter.

Alkaline carbonates act in the same manner as alkalies, except that the change of colour is accompanied with effervescence. Chlorine entirely destroys the red colour, leaving a yellow solution. Sulphuretted hydrogen changes the red to brown, but does not alter the chemical character of the solution. Stannic chloride changes the red to a beautiful dark magenta colour. On boiling with metallic mercury the red colour is changed to a dark violet or purple.

Mercuric nitrate and chloride both give a slight white or pinkish precipitate, soluble in water.

Hydrate of barium yields a yellowish green precipitate, as does also hydrate of calcium, both becoming brown when deprived of moisture. No precipitates are given by chloride of platinum, nitrate of silver, or the usual alkaloidal reagents, except very slight ones by iodohydrargyrate and trinitrophenic acid.

Carbonic acid does not redden the colourless or green modification, but though possessing this property, esteemed in cochineal, it does not appear to be practically useful as an indicator in alkalimetry.

Peroxide of hydrogen appeared to give no reaction.

Sulphurous acid leaves the colour of a brown shade.

To test paper all the solutions have an acid reaction.

Neutral and basic acetates of lead give precipitates of a colour varying from a green to a bluish green. These precipitates, decomposed by sulphuric acid, yield the colouring matter to the solution, as already mentioned, and deposit sulphate of lead. The action of reagents leads to the conclusion that the colouring matter is an acid, and that as such it forms salts—the crystals and precipitates described.

The analysis of the lead salt led to the formula $Pb_2 C_{21} H_{29} O_{30}$.

The author's report in the *Pharmaceutical Journal* (p. 651) is illustrated by diagrams of crystals of the sodium salt, the ammonio-sodium, and the ammonio-potassium salts. It also contains diagrams of the principal spectra of the colouring matter.

Estimation of the Alkaloids of Sabadilla and Physostigma. E. Masing. (*Archiv der Pharm.*, October, 310–317.) The author has found that pure veratrine, dissolved with the requisite quantity of acid in 14,670 parts of water, still yields with Mayer's solution a faint turbidity; while on the addition of 1 per cent. $H_2 S O_4$, the limit of the reaction is reached with a dilution of 1 in 11,400.

The sabadilline double iodide dissolves in 17,630 parts of pure water, and in 19,300 parts of water containing 1 per cent. sulphuric acid.

The solubility of the hydrargyro-iodide of sabatrine is greater than that of the preceding alkaloids: in pure and in acidulated water, containing 1 per cent. $H_2 S O_4$, it appears to be 1 in 2450.

Commercial veratrine gives, with Mayer's solution, a more distinct indication of alkaloid than that employed (in one case 0·8645, instead of 0·7772 gram used); the cause for this variation, which in the presence of sabadilline and sabatrine should be the reverse, has not been ascertained. Air-dried sabadilla seeds indicated an amount of alkaloids, which, if calculated as veratrine, was equal to 3·61 per cent.

Physostigmine, prepared by Vée and Leven's process (*Amer. Journ.*

Pharm, 1865, 204), ceases to react with Mayer's solution when dissolved in 9500 parts of pure water, or in 8800 parts of acidulated water, containing 1 per cent. H_2SO_4. One kilogram of Calabar beans treated in this manner yielded only 0·7482 gram of alkaloid; while Mayer's test solution indicated, in two experiments, 0·399 and 0·433 per cent. respectively.

Action of Hydrogen Sulphide on Alkaloids. E. Schmidt. (*Liebig's Annalen*, clxxx., 287; *Journ. Chem. Soc.*, July, 1876.) Almost all the known vegetable bases are acted upon by hydrogen sulphide. The substances thereby formed, though in some cases definite compounds, appear for the most part to be mixtures which cannot be separated, owing to the facility with which they are decomposed. The author has examined more particularly the compounds formed with strychnine and brucine.

Strychnine.—When an alcoholic solution of strychnine is saturated with hydrogen sulphide, and left at rest for some time, it gradually deposits fine orange red needles of a substance to which Schmidt attributes the formula $2\,C_{21}H_{22}N_2O_2, 3\,H_2S_2$. This substance differs in colour and crystalline form from that which Hofmann obtained by the action of ammonium sulphide on strychnine, but cannot be distinguished therefrom by analysis. When kept for a day or two, it gives off hydrogen sulphide, and slowly changes colour; whereas Hofmann's compound keeps for months without alteration. It was ascertained by direct experiment that this compound is formed only in presence of oxygen, not when air is completely excluded. Its formation may be represented by the equation:—

$$2\,C_{21}H_{22}N_2O_2 + 6\,H_2S + 3O = \begin{matrix} C_{21}H_{22}N_2O_2 \\ C_{21}H_{22}N_2O_2 \end{matrix} \left\{ \begin{matrix} H_2S_2 \\ H_2S_2 \\ H_2S_2 \end{matrix} \right. + 3\,H_2O.$$

The compound is decomposed by mineral acids, with separation of oily drops of hydrogen bisulphide and formation of strychnine salts.

Brucine.—When hydrogen sulphide is passed into a strong solution of brucine in alcohol, freely exposed to the air, the liquid immediately assumes a yellow colour, and after a time deposits yellow needles, which, on prolonged standing, become covered with a yellowish red layer of another sulphur compound. The yellow needles gave on analysis numbers agreeing with the formula $C_{23}H_{26}N_2O_4H_2S_2 + 2\,H_2O$, which is that of a compound of 1 molecule of brucine with 1 molecule of hydrogen bisulphide. This formula, however, is of no value; for the substance after drying possesses altered properties, and its composition is not represented by the formula $C_{22} H_{26} N_2 O_4 H_2 S_2$. The crystals are prismatic, insoluble in the ordinary solvents, and undergo partial decomposition when kept. They are decomposed by mineral acids, with separation of hydrogen bisulphide and formation of brucine salts. The melting point is about 125°.

A second derivative of brucine is easily obtained by passing hydrogen sulphide into a dilute alcoholic solution of the alkaloid (1 in 100), till the liquid assumes a deep yellow colour, and allowing it to stand in loosely-covered vessels. In the course of twenty-four hours there is formed a deposit of ruby red crystals, which after washing with alcohol and ether have the composition represented by the formula $C_{23} H_{26} N_2 O_4 \begin{matrix} H_2 S_2 \\ H_2 S_2 \end{matrix}$. The crystals belong to the triclinic system. In their behaviour they closely resemble the foregoing yellow compound.

The formation of these brucine compounds is dependent, like that of the strychnine compound, on the presence of oxygen; for if the air be perfectly excluded not a trace of them is produced. The following equations may perhaps represent their formation :—

$$C_{23} H_{26} N_2 O_4 + 2 H_2 S + O = H_2 O + C_{23} H_{26} N_2 O_4 H_2 S_2 ;$$

$$C_{23} H_{26} N_2 O_4 + 4 H_2 S + O_2 = 2 H_2 O + C_{23} H_{26} N_2 O_4 \left\{ \begin{matrix} H_2 S_2 \\ H_2 S \end{matrix} \right. .$$

Determination of Minute Quantities of Arsenic Present in Mineral and Organic Substances. M. Crommydes. (*Bull. Soc. Chim.* [2], xxv., 348; *Journ. Chem. Soc.*, July, 1876.) The author considers all the methods usually employed in the determination of small amounts of arsenic to be inconvenient or inaccurate; and gives the preference to the method first proposed by Gautier, which consists in evolving the arsenic from a Marsh's apparatus in the form of arseniuretted hydrogen, and weighing the metallic arsenic obtained in the combustion-tube. As evidence of the extreme accuracy of this method, the following results are given. Orpiment of absolute purity was taken :—

Weight of Orpiment taken.	Metallic Arsenic found.	Metallic Arsenic calculated.
0·0108	0·0065	0·00658
0·0052	0·0330	0·00308

On determining the arsenic in a portion of the same sample of orpiment, by the ammonium-magnesium arsenate method, inaccurate results were obtained, as will be seen from the following :—

Orpiment taken.	Ammonium-magnesium Arsenate obtained.	Arsenic found.	Arsenic calculated.
0·55	0·8755	0·344	0·3353

Gautier's method is equally accurate when applied to the determination of arsenic contained in large quantities of organic matter. Known volumes of a standard orpiment solution (0·5 gram of orpiment dissolved in 1 litre of water) were introduced into 100 grams of meat, and the amount of arsenic determined. The results are given below:—

Weight of Meat taken.	C.C. of Solution taken.	Weight of Orpiment.	Weight of Arsenic obtained.	Arsenic calculated.
100 grams	5	0·0025	0·0015	0·00152
100 ,,	10	0·0050	0.0030	0·00301
100 ,,	5	0·0025	0·0015	0·00152

It is necessary, however, to abstain from carrying on the carbonization of the organic matter too far, as it is found that the greater part of the arsenic remains in the charcoal as sulphide. In order to be quite certain that all the arsenic is in solution, the organic matter which has been successively treated with nitric acid, sulphuric acid, and again with nitric acid, is calcined; the residue again treated with a small quantity of nitric acid; and the solution evaporated down, but not calcined. By this process all the arsenic is obtained, and no sulphide remains in the charcoal.

Crystallized Hydrobromate of Conine. M. Mourrut. (*Répertoire de Pharm.*, 1876, 369.) Of the various salts of conine the hydrobromate is the one most easily obtainable in a crystallized state. The salts prepared from the ordinary brown conine are generally contaminated with a brownish black substance, which cannot be completely removed without great difficulty and loss. The German conine, which is nearly colourless, presents no such difficulties, and yields crystals of the pure hydrobromate on being mixed with dilute hydrobromic acid. The latter is added to the alkaloid drop by drop until the mixture has a slight acid reaction, when the salt begins to crystallize out in the form of colourless prismatic needles, which are very soluble in water but less readily so in ether and chloroform. They fuse at 100° C., but at a higher temperature they are decomposed, giving off the odour of conine. By the careful evaporation of the liquor at a gentle heat, a large yield of crystals can be obtained.

Hydrobromate of conine has been administered with success to children suffering from whooping cough, in frequently repeated doses of two to five milligrams each. The subcutaneous injection of five milligrams of the salt is recommended by Dr. Regnault for the relief of sciatica.

Test for Sperm Oil. W. Gilmour. (*Pharm. Journ.*, 3rd series, vii., 329.) The process recommended is as follows :—Take one part by weight of sulphuric acid, sp. gr. 1·84, to four parts of oil, and mix thoroughly. Let it stand for about twenty minutes, shaking once or twice in the interval, and then add about three ounces of distilled water. On now shaking the mixture a very thick saponaceous-like compound will be formed, which should be throughout of uniform colour, showing that the mixture is complete. After letting this stand for about eight hours, it will be found to have separated into two layers, the one underneath being clear and colourless, and the one above a dark brown viscous mass, in which the cetin, if present, will be found floating, giving it a mottled appearance. It should now be set aside for a further interval of eight or twelve hours, so that all cetin may separate; on which it should be transferred to a larger vessel containing three or four times its volume of water, and the whole thoroughly shaken. The cetin will now be found floating on the surface of the liquid, and should be filtered out and thorougly washed until the filtrate ceases to have a milky appearance, and then dried spontaneously. As thus obtained, the cetin is light, crystalline, pearl-white, not unlike quinine in appearance, but more glistening, and has neither taste nor smell. According to Christison, it is a pure proximate principle, intermediate between wax and the concrete oils, and presenting all the leading properties of spermaceti, but less greasy, and fusible only at the higher temperature of 120°. It undergoes partial saponification when boiled with caustic potash solution, forming a brittle soap only in part soluble in water, and composed chiefly of palmitate of potash, oleate of potash, and a crystalline principle called ethal.

The following table gives the amount recovered from one ounce by weight of ten different samples, with the specific gravity of each oil respectively :—

Sample.	Sp. Gr. 60 F.	Cetin in grains.
1	·884	16·2
2	·880	15·5
3	·886	11·
4	·883	7·1
5	·881	6·5
6	·884	6·
7	·889	4·2
8	·883	3·
9	·882	none.
10	·896	none.

All the foregoing oils have been tested in the manner indicated more than once (in most instances repeatedly) with nearly uniform results, so that it appears reasonable to assume the utility of this mode of determining their purity.

The author has endeavoured to extract the spermaceti, previously known by this means to be present in some of these oils, by boiling in rectified spirit and subsequent crystallization. Spermaceti, it is well known, is soluble in boiling rectified spirit, whilst sperm oil is not; yet every attempt thus to extract the spermaceti failed; but whether from some adulterations of these oils with other oils soluble in rectified spirit, or from other impurities still, or from some defect in the manipulation, the author has been unable to determine. It shows, however, not only how prevalent adulteration is in this valuable oil, but also how defective the means are for its detection, when dealers in every case prudently refrain from giving any opinion on its purity, and when further, *it is known that the annual consumption is much in excess of the amount actually imported.* In circumstances such as these the test may prove of much practical utility to those engaged in examinations of this kind.

Cresotic Acid and Sodium Cresotate. Dr. C. F. Beiss. (*New Remedies*, from *Pharm. Centralhalle*, 1876, 273.) The fact that cresotic acid is homologous with salicylic acid leads the author to the supposition that its therapeutic action might likewise be similar. The results of his experiments, especially in cases of fever, leave no doubt that cresotic acid is a most effective antipyretic remedy, corresponding in its actions to quina or to salicylic acid. Sodium cresotate was administered in doses of 6 to 8 grams. After its administration the patients sometimes complained of a bad taste, but never of disagreeable sensations; sometimes it produced humming in the ears, but very rarely hardness of hearing after a few hours.

Cresotic or carbocresylic acid, $C_8 H_8 O_3$, is derived from cresol or cresyl-alcohol ($C_7 H_8 O$), in the same way as salicylic acid ($C_7 H_6 O_3$) is from phenol or phenyl-alcohol ($C_6 H_6 O$), by passing carbonic acid gas into cresol (or phenol) containing metallic sodium. The cresotic acid crystallizes from its hot watery solution in colourless prisms. It is sparingly soluble in cold water, readily in ether, alcohol, and alkaline solutions. Ferric chloride produces the same violet coloration as with salicylic acid. Comparative experiments will have to be made to determine which of these two acids has stronger antipyretic powers.

Determination of the Impurities in Nitre. Prof. R. Fresenius. (*Zeitschr. für Analyt.-Chem.*, 1876, 68; *Journ. Chem. Soc.*, 1876, 651.)

As chemists are frequently required to determine the traces of foreign salts in different kinds of purified saltpetre, the author publishes a method of procedure, which from long experience he has found to give the most accurate results.

1. *Determination of the Water.*—This is done in the usual way, by ascertaining the loss on heating a weighed portion in a platinum crucible. The temperature may be gradually raised until the salt just begins to melt.

2. *Determination of the Chlorine and of the Residue insoluble in Water.*—100 grams are dissolved in hot water, and the residue collected and weighed on a tared filter. The filtrate is acidified with pure nitric acid, mixed with silver nitrate, and kept for some time in the dark at a gentle heat. The precipitate is then collected on a small filter, and determined either directly as silver chloride, or by reduction to metallic silver.

3. *Determination of the Lime, Magnesia, and Soda.*—100 grams of salt are dissolved with 1·5 gram of potassium chloride, in about 100 c.c. of water; the solution is then mixed with about 500 c.c. of pure alcohol of 96 per cent., well stirred, and the crystalline residue separated by filtration and washed with alcohol. The filtrate is then evaporated to dryness, the residue dissolved in a little water, and the solution treated as before with alcohol, and filtered. This having been again repeated, an alcoholic solution is obtained containing all the lime, magnesia, and soda, but only a small quantity of potassium. This solution is now evaporated to dryness, and the residual salts converted into chlorides by digestion with hydrochloric acid, after which the lime can be separated by ammonium oxalate, and the magnesia by ammonium phosphate. The filtrate, freed from lime and magnesia, is now heated in a platinum basin to expel ammonia, one or two drops of ferric chloride added, and afterwards ammonia or ammonium carbonate, to slight alkaline reaction; the liquid is then warmed, the basic phosphate of iron filtered off, and the filtrate evaporated to dryness, and heated until the ammonium salts are expelled. From the residue the potassium is separated as potassio-platinic chloride, together with the excess of the platinum salt, decomposed by careful heating in a stream of hydrogen gas. Finally, the sodium chloride is extracted with water, the solution evaporated to dryness, and the sodium calculated from the weight of the residue.

An actual analysis gave:—

KNO_3	$NaNO_3$	$Mg(NO_3)_2$	$Ca(NO_3)_2$	$NaCl$	Insoluble.	Moisture.
99·8124	0·0207	0·0093	0·0006	0·0134	0·0210	0·1226 = 100

Reactions of Carbolic, Benzoic, and Salicylic Acids. Dr. R. Godeffroy. (Abstracted from the *Zeitschr. des oesterr. Apoth. Ver.*, in *New Remedies.*)

Reactions of Carbolic Acid.

1. Solutions of caustic alkalies dissolve phenol readily, with formation of phenates (carbolates) of alkali metals.

2. On treating phenol with an excess of fused caustic potassa, a copious disengagement of hydrogen gas occurs after a short time; while at the same time there are formed oxybenzoic and salicylic acids and diphenol.

3. Potassium or sodium dissolves in melted phenol, with disengagement of hydrogen and formation of phenate of the alkali metal.

4. On passing dry carbonic acid into phenol containing sodium in solution, sodium salicylate is formed, together with paraoxybenzoic acid.

5. Pieces of caustic potassa brought into a solution of phenol in chloroform became covered with a rose red shell, but the mixture soon became very hot, dark coloured, and thick.

On adding to an aqueous solution of phenol a little potassa, evaporating to dryness, and after the residue has become cold, pouring over it some chloroform, a magnificent purple colour makes its appearance, which is ascribed to the formation of rosolic acid. (J. Guareschi, *Gaz. Chim. Ital.*, 3, 402.)

6. A watery solution of phenol immediately discolours potassium permanganate. If the latter be added until the colour ceases to disappear, the products of oxidation are only carbonic and oxalic acids; if, however, the oxidation remains incomplete, the products are a resin, closely allied in composition to phenol, a small quantity of oxalic acid, and a few other bodies.

7. Strong hydrochloric acid is poured upon potassium chlorate in a test tube, so that the fluid stands a few centimetres over the salt; after the subsidence of the first reaction, and the removal of the chlorine vapours from the upper portion of the test-tube by blowing, the liquid is diluted with $1\frac{1}{2}$ volume of water; water of ammonia is now poured into the test-tube, so that the latter forms a separate layer over the other. On adding to this test liquid a watery solution of phenol, the ammoniacal layer assumes a tint, varying with the quantity of phenol, from rose red, through blood red, reddish, or dark brown. One part of phenol may be easily recognised in 12,000 parts of liquid. (Ch. Rice, *Amer. Journ. Pharm.*, 1873, 98.)

8. On passing the vapour of phenol over zinc in powder, benzol and zinc oxide are formed: $2\,C_6H_5OH + Zn_2 = 2\,ZnO + 2\,C_6H_6$.

9. On adding an excess of bromine water to a dilute aqueous solution of phenol, there is immediately formed a yellowish white flocculent precipitate of tribromphenol, $C_6 H_2 Br_3 O H$. This reaction is said to be distinguishable in a dilution of 1 in 43,700, and by waiting a few hours, even in one of 1 in 54,600 parts.

10. On shaking a watery solution of phenol with aqueous ammonia, and exposing the liquid to the vapour of bromine, the liquid assumes a distinct blue colour, even in presence of only $\frac{1}{20000}$th part of phenol. (F. A. Flückiger, *Archiv der Pharm.* [3], 3–30.)

11. On mixing a solution of a hypochlorate with ammonia and a liquid containing phenol, an intense blue colour is developed. Very small quantities of phenol may be detected by this reaction.

12. Dilute solutions of phenol are coloured violet by neutral aqueous ferric chloride solution. Alcoholic ferric chloride solution produces a blue colour with alcoholic phenol solution. Free acids prevent the reaction.

13. A watery solution of phenol reduces metallic mercury from a solution of mercurous nitrate, and the liquid assumes a red colour, which is said to be visible still if only $\frac{1}{60000}$th part of phenol is present.

14. By united action of iodine and mercuric oxide upon phenol, substitution products of the latter, containing iodine, are formed. (P. Weselsky, *Wien. Ber.*, 69, ii., 832.)

15. Albumen is immediately coagulated by phenol.

16. Concentrated sulphuric acid dissolves phenol without colour, and produces phenol sulphuric (sulpho-carbolic, sulphophenic) acids. Warmed with fuming sulphuric acid, phenol yields pheno-disulphuric acid, which latter imparts a ruby colour to ferric chloride solution.

17. On heating phenol with oxalic and sulphuric acids a beautifully red mass is obtained, which assumes a magnificent purple shade with alkalies. This is owing to the formation of coraline.

18. On heating phenol with sublimed (and, therefore, dehydrated) oxalic acid to 110°–120° C., rosolic acid is formed. ("Prud'homme," *Monit. Scient.* [3], 3890.)

19. Nitric acid acts upon phenol with more or less violence, depending upon its concentration, and produces mononitrophenol, $C_6 H_4 (N O_2) O H$, or dinitrophenol, $C_6 H_3 (N O_2)_2 O H$, or trinitrophenol, $C_6 H_2 (N O)_3 O H$. This latter is commonly known as picric acid.

Reactions of Benzoic Acids.

1. On passing the vapour of benzoic acid over faintly ignited zinc powder, essential oil of bitter almonds is formed. (Baeyer.)

2. Benzoic acid, heated in a retort with coarsely ground pumice stone, splits into benzol and carbonic acid. If overheated, carbon is separated and naphthalin and pyrogenic oils are formed. (Barreswil and Boudault.)

3. On heating benzoic acid with a mixture of acid sodium sulphate and sodium chloride to 200° C., there are formed benzyl chloride, hydrochloric acid, and normal sodium sulphate. (Beketoff.)

4. Benzoic acid is soluble in solution of sodium phosphates, which give up to it 1 or 2 atoms of sodium, producing thereby sodium benzoate. The solutions have an acid reaction, and give up benzoic acid on evaporation, or to ether. (J. Donath.)

5. On mixing 3 molecules of benzoic acid with 1 molecule of glucose, and heating with a large excess of strong sulphuric acid, the liquid assumes a fine blood red colour, which disappears after a while; finally the mass turns brown and black.

6. Aqueous chromic acid, or potassium chromate and sulphuric acid, do not alter benzoic acid; no odour of oil of bitter almonds is developed, and the chromic acid is not reduced (distinction from cinnamic acid).

7. A neutral solution of ferric chloride produces in neutral solutions of benzoates a flesh coloured precipitate of ferric benzoate, insoluble in water and acetic acid, but decomposed by hydrochloric acid, which produces free benzoic acid and ferric chloride.

8. Silver nitrate produces no precipitate in a solution of benzoic acid; but on saturating the free acid with ammonia a white crystalline precipitate of silver benzoate is immediately produced. This is soluble in ammonia, acetic acid, and hot water.

9. Mercurous nitrate produces in a solution of benzoic acid a white crystalline precipitate of mercurous benzoate, very difficultly soluble in water. Alkaline benzoates produce a voluminous non-crystalline precipitate.

Reactions of Salicylic Acid.

1. Salicylic acid, heated above its melting point, splits into carbon dioxide and phenol:—

$$C_7 H_6 O_3 \quad C O_2 + C_6 H_6 O.$$

2. On distilling salicylic acid with excess of lime, calcium carbonate is formed and phenol distils over:—

$$C_7 H_6 O_3 + Ca O = Ca C O_3 + C_6 H_6 O.$$

3. If salicylic is heated with amylic alcohol (fusel oil) under pressure at 250° C., it splits likewise into carbon dioxide and phenol.

4. Sodium-amalgam, acting upon an acidulated solution of salicylic acid, which must be constantly kept acid, transforms it into salicylous acid:—

$$C_7 H_6 O_3 + H_2 = C_7 H_6 O_2 + H_2 O.$$

5. Sulphuric acid dissolves salicylic acid without colour, and forms from it two isomeric sulpho-salicylic acids.

6. On heating salicylic acid with dilute sulphuric acid and manganic oxide, formic acid is produced which may be distilled off.

7. Dilute sulphuric acid and potassium chromate likewise convert salicylic acid into formic and carbonic acids. (Kraut.)

8. On heating a mixture of sulphuric acid, wood spirit (methyl alcohol), and salicylic acid, an agreeably aromatic liquid distils over, which is methylic salicylate.

9. Concentrated nitric acid converts salicylic acid at the common temperature into nitriosalicylic acid, $C_7 H_5 (N O_2) O_3$; dilute nitric acid produces the same result by heating.

10. Fuming nitric, or a mixture of concentrated nitric and sulphuric acids, converts salicylic acid, under violent reaction, into picric acid, $C_6 H_3 (N O_2)_3 O$, and carbonic acid.

11. Chlorine and bromine produce substitution products.

12. Iodine acts upon a watery solution of the acid only when heated; if melted with dry salicylic acid it produces iodized substitution products and a red amorphous body.

13. Warm hydrochloric acid dissolves considerable quantities of salicylic acid; on cooling or on dilution with water it separates again in brilliant white fine needles. (Godeffroy.)

14. Potassium chlorate and hydrochloric acid convert it into chloranil (tetrachlorchinon), $C_6 Cl_4 O_2$.

15. On heating salicylic with aqueous hydriodic acid to 280° C., phenylic ether and carbonic acid are formed.

16. On distilling it with phosphorus pentachloride, chlorosalicylchloride, $C_7 H_4 Cl_2 O$, is formed.

17. If phosphorus trichloride be added to a mixture of salicylic acid and anilin, salicylanilide, $C_6 H_5 N H. (C_7 H_5 O_2)$, is produced.

18. Iodine and mercuric oxide acting on salicylic acid produce iodized substitution products. (P. Weselsky, *Wien. Ber.* 69, ii., 832.)

19. On mixing salicylic acid (3 molecules) with glucose (1 molecule), pouring over them a large excess of concentrated sulphuric acid, and gently warming, a fine blood red colour is produced; this colour disappears after a while, and the mass turns brown, and finally black. (T. L. Phipson, *Chem. News*, 28, 13.)

20. Caustic potassa solution dissolves salicylic acid readily; the solution soon turns brown in the air.

21. Watery solution of salicylic acid and its salts is coloured intensely violet by ferric salts. This reaction is so delicate that Aug. Vogel. (*Pharm. Zeit. f. Russl.*, 1876, 398, from *Neu. Rep. f. Pharm.*) has proposed it as a substitute for alkaline sulphocyanides as reagents for ferric compounds. In strongly acid solutions, however, this reaction does not take place. H. Weiske employs it as an indicator in alkalimetry. (W. Weith, *Ber. der deutsch. Chem.-Ges.*, 1866, 342; *New Remedies* v., 137.)

On evaporating the intensely violet solution containing salicylic acid and ferric salt to dryness, the colour disappears entirely; but the least quantity of water restores it. (Godeffroy.)

22. Salicylic acid mixed with cupric sulphate and caustic soda solution produces a solution of an intensely bluish green colour, from which even a large excess of alkali fails to precipitate any cupric oxide. (*Zeit. f. Anal.-Chem.*)

23. Solution of sodium salicylate forms a grass green liquid with cupric sulphate solution (Hager, *Pharm. Centralh.*)

24. Silver nitrate produces a white precipitate in solutions of alkaline salicylates, but no precipitate in solution of salicylic acid.

25. Lead acetate behaves like the preceding.

26. On mixing a hot saccharated solution of simple calcium salicylate, Ca $(C_7 H_5 O_3)_2$, obtained from calcium carbonate and aqueous solution of the acid, with a boiling solution of caustic lime in saccharine water, a heavy crystalline precipitate of so-called neutral calcium salicylate, $Ca C_7 H_4 O_3$, almost insoluble in water, is produced. (Limpricht, *Organ. Chem.*, 1862, 904.)

27. If a solution of salicylic acid is boiled with a solution of potassium ferrocyanide, hydrocyanic acid is produced, and the liquid becomes turbid. This reaction is very delicate, and permits the detection of very small quantities of salicylic by means of the reagents for hydrocyanic acid. (Godeffroy.)

28. On boiling a solution of salicylic acid with a solution of potassium permanganate, the characteristic colour of the latter is immediately destroyed, and carbonic acid, phenol, and brown hydrated manganic oxide are produced.

Betulin. U. Hausmann. (*Liebig's Annalen*, clxxxii., 368–380.) The author has obtained this substance from the light, corky layer of birch bark by exhausting it with boiling water, then boiling the exhausted bark with alcohol, precipitating the alcoholic decoction by an alcoholic solution of neutral acetate of lead, heating the mixture again to the boiling point, filtering, removing the lead from the filtrate by carbonate of ammonium, again filtering, and allowing to cool. A crystalline magma of impure betulin was thus obtained, which was purified by repeated washing with small quantities of ether and recrystallization from boiling alcohol.

Pure betulin forms long, colourless, inodorous, and tasteless prisms, which when dry present the appearance of asbestos. It fuses at 258° C., and when heated beyond that point sublimes in long, very thin needles. It is insoluble in water, slightly soluble in cold alcohol, ether, benzol, and chloroform, and freely soluble in hot alcohol; also in glacial acetic acid, oil of almonds, and turpentine. Its composition is represented by the formula $C_{36} H_{60} O_3$. By dry distillation oily products are obtained, possessing the characteristic odour of russia leather. With acetic anhydride it forms betulin diacetate, a crystallizable ether, the composition of which agrees with the formula $C_{40} H_{64} O_5$. With nitric acid it forms betulinamaric acid, $C_{36} H_{52} O_{16}$; and by the action of chromic anhydride it is converted into betulinic acid, $C_{36} H_{54} O_6$.

Detection of Mineral Acids by Colchicine. Prof. F. A. Flückiger. (*Journ. Chem. Soc.*, from *Repert. Pharm.*, xxv., 18.) Mohr has observed that under certain conditions the behaviour of inorganic acids differs totally from that of the organic acids; this difference may be utilized for their discovery in presence of organic acids; for example, in vinegar or lemon juice.

Potassium sulphocyanate in a dilute solution of ferric acetate causes no change, but if there be the smallest trace of hydrochloric, nitric, or sulphuric acid present, the blood red colour of ferric sulphocyanate is at once apparent; this, however, quickly vanishes on the addition of an acetate or oxalate; but in this case phosphoric acid acts like the organic acids in preventing the formation of ferric sulphocyanate. Another of Mohr's methods depends on the fact that iodine is precipitated from a solution of potassium iodide if a ferric salt with an inorganic acid radicle be added. Ferric acetate causes no precipitation in a solution of potassium iodide, but if the smallest trace of an inorganic acid be present the iodine is immediately precipitated.

But there is a case the reverse of this, in which the inorganic retards and the organic acid hastens the reaction. A solution of pure ferrous sulphate mixed with a saturated solution of gallic acid produces no change if the air be excluded, but acetates immediately produced in it a violet colour.

Still more remarkable effects are produced by colchicine. Some colchicine was extracted from a few grams of the seeds by means of alcohol and water, the yellowish solution was diluted till the colour was scarcely perceptible.

With concentrated sulphuric or nitric acid it gave a very distinct yellow, and on adding a drop of hydrochloric acid to this solution a bluish violet was produced.

If some colchicine solution with a drop of nitric acid is strongly concentrated, and then a fragment of sodium acetate added, an orange colour is produced.

If to a portion acidulated with sulphuric acid, a mixture of iodide of potassium and iodide of mercury, in the proportion of 50 to 13·5, is added, a precipitate is formed. By means of this solution it was easy to detect half a per cent. of sulphuric acid in vinegar.

The Detection of Mineral Adulterants in Flour. Dr. C. Himly. (*Pharmaceutische Handelsblatt*, No. 76.) As the complete incineration of flour is a somewhat tedious operation, the author prefers to effect the separation of mineral adulterants by means of chloroform. Flour being much lighter, and the ordinary mineral adulterants (limestone, chalk, heavy spar, gypsum, and bone ash) much heavier, than chloroform, a sample of the suspected flour need only be shaken with it in a test-tube, and then allowed to separate A very slight dark coloured sediment, emanating from the millstone, will be deposited from a genuine flour, but any appreciable white sediment indicates adulteration. The sediment, of course, can be weighed and further examined.

The author has also employed this process for the separation of white arsenic from a sample of flour in a forensic investigation.

Alteration of Cantharidin in Cantharides. R. Wolff. (*Zeitschr. des oester Apoth. Ver.*, xv., 102; *Pharm. Journ.*, 3rd series, vii., 918). The experience that cantharides kept dry remain active for a long time, whilst when damp they rapidly lose their activity; and further, the property of cantharidin not to be broken up under the action of strong sulphuric acid, whilst in the cantharides it loses almost directly its vesicatory action upon the skin, led the author, who is an apothecary in Buenos Ayres, to the conclusion that there must be present in cantharides some substance which, assisted by moisture, effected a change in the cantharidin. As it is known that there is an evolution of ammonia when an aqueous solution of old cantharides is heated with caustic potash, the opinion appeared to be justified that ammonia might play an important part in the decomposition of the cantharidin.

To clear up this point the author extracted the cantharidin from

100 grams of *Lytta aspersa.* This species is used in Buenos Ayres, and is said to excel the ordinary *Lytta vesicatoria* in its greater activity, which, when carefully dried, the insects retain during many years. From the 100 grams he obtained 0·815 gram of pure cantharidin, and also from the green-brown oily substance from which the cantharidin had separated upon treating it with ether and chloroform, 0·46 gram of a new body in tabular crystals, which, although it also had a vesicatory action, differed from cantharidin in its chemical properties as well as its form of crystallization.

The crystals of this new body are difficultly soluble in cold water (about 1 in 6600); they are rather more soluble in boiling water, but separate upon cooling. In alcohol they dissolve in the proportion of 1 in 680; in ether, 1 in 390; in chloroform, 1 in 60. Hydrochloric acid is without action upon them; on the other hand, they are readily dissolved by nitric and sulphuric acids, especially when hot. In the latter case, however, decomposition appears to take place, since upon the addition of water cantharidin is precipitated, ammonium nitrate or sulphate being formed at the same time.

When pulverized the new body dissolves at the ordinary temperature in solution of potash or ammonia; and upon the addition of an acid is again precipitated unaltered. If the ammoniacal solution be allowed to stand for some time in a moderately warm place, after the excess of ammonia has been given off, the solution readily reddens blue litmus paper. If the ammoniacal solution be concentrated, crystals of the compound with ammonia are formed, which decompose upon drying, with formation of ammonia, and are then difficultly soluble in cold water.

Upon evaporating the ammoniacal solution to dryness a white crystalline residue is obtained, that appears to be insoluble in cold water, but in boiling water it dissolves without difficulty. From the solution, which reddens litmus paper, acicular crystals separate upon cooling, which constitute a second nitrogenous compound of cantharidin. The author made no closer investigation as to the composition of these two compounds. In the remainder of the paper he simply distinguishes them as No. 1 and No. 2. Compound No. 2, placed on the skin, acts as a vesicant. It dissolves with difficulty in cold water, but readily in boiling water. In alcohol, ether, and chloroform it is very difficultly soluble, even when warmed. In acetic ether it is easily soluble, and upon evaporation cantharidin is left as a residue. The crystals dissolve readily in strong sulphuric acid, and no precipitation takes place upon the addition of water. Strong nitric and hydrochloric acids behave similarly. It appears as if the acids enter into combination without causing decomposition. In ammonia this compound No. 2 dissolves rather freely, but separates in acicular crystals upon the addition of acids. If the ammoniacal solution be allowed to evaporate slowly, crystals are formed which consist of compound No. 2 and ammonia; upon drying and warming, these crystals are decomposed with evolution of ammonia. It is also dissolved by potash solution, but it then separates unaltered upon the addition of acids. Upon evaporating the solution in alkali to dryness, ammonia is evolved, and part of the compound No. 2 passes into compound No 1. No. 2 appears to undergo no change upon fusion or sublimation; No. 1 also appears to melt and sublime without loss of weight.

If solution of a zinc salt be added to solution of cantharidin in caustic potash as long as any precipitate is formed, then a sufficiency of ammonia solution to dissolve the precipitate produced, and finally an acid in excess, the compound No. 1 separates as a white granular crystalline precipitate. Salts of copper and magnesia act like the salts of zinc, as probably do others that behave similarly towards ammonia. As magnesia salts are present in considerable quantity in cantharides, the author is of opinion that these, after the death of the insect, in presence of ammonia, quickly induce an alteration of the cantharidin into compound No. 1, and that this change is more rapid and complete in proportion as the conditions are favourable, which appears to be the case in the European cantharides, that so soon lose their activity. If by moisture a progressive formation of ammonia is favoured, the compound No. 1 is formed, and this after a time is in turn converted into compound No. 2, which then probably enters into combination with acids contained in the cantharides. The author has no doubt that a more exact investigation of the nitrogenous compounds would afford a method of recovering the cantharidin that has undergone alteration in cantharides, the details of which would vary according to the degree of change that has taken place.

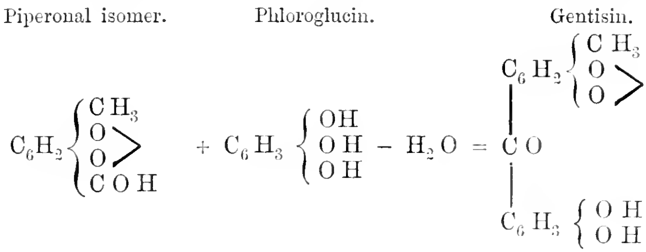
Rhodeine, a New Reaction of Aniline. G. Jacquemin. (*Journ. de Pharm. et de Chim.*, xxiv., 204.) Professor Dragendorff has shown that the well-known reaction of aniline with chlorinated lime fails to indicate this substance if its solution contains less than 1 in 6000. A few years ago the author observed that by substituting sodium hypochlorite for the chlorinated lime, 0·01 gram of anilin dissolved in 100 c.c. of water, or 1 in 10,000, still produces a distinct violet coloration; whereas solutions containing 1 part in

20,000 give but a faint brown, non-characteristic colour; and those containing 1 part in 50,000 undergo no visible change whatever. He has now discovered a reaction by means of which aniline can be distinctly recognised in solutions containing 1 part in 250,000, and which may therefore be advantageously employed when the hypochlorite fails. By the addition of a few drops of largely diluted solution of ammonium sulphide (1 drop to 30 c.c. of water) to the colourless or faintly brown mixture of aniline solution and sodium hypochlorite, a beautiful pink coloration is produced, which is still discernible in a solution containing but 4 milligrams of aniline per litre of water, but is instantly destroyed by an excess of ammonium sulphate.

The author hopes to isolate and to further investigate this new derivative of aniline, to which he has given the name *rhodeine*.

Gentisin (Gentianin). H. Hlasiwetz and J. Habermann (*Liebig's Annalen*, clxxx., 343; *Journ. Chem. Soc.*, July, 1876.) The author's latest researches on this subject establish the indentity of pyrogentisic acid with hydroquinone. The true melting point of the latter is 169°. Gentisic acid is proved to be identical with oxysalicylic acid, which melts when pure at 196°–197°.

By the action of sodium amalgam upon gentisin a body is formed having the formula $C_{14}H_{10}O_5$, which differs from that of gentisin by CO. Fusel gentisin, when treated with dry hydrochloric acid, yielded methylchloride. Gentisin, therefore, contains the radical CH_3. In a previous paper a diacetyl-gentisin was described, showing the presence in gentisin of two hydroxyl-groups. These facts admit of explanation on the assumption that gentisin is formed by the combination of phloroglucin with a body isomeric with piperonal, thus:—



$$C_6H_2\left\{\begin{matrix}CH_3\\O\\O\\COH\end{matrix}\right. + C_6H_3\left\{\begin{matrix}OH\\OH\\OH\end{matrix}\right. - H_2O = \begin{matrix}C_6H_2\left\{\begin{matrix}CH_3\\O\\O\end{matrix}\right.\\|\\CO\\|\\C_6H_3\left\{\begin{matrix}OH\\OH\end{matrix}\right.\end{matrix}$$

Veratrine. E. Schmidt and R. Kopper. (From *Ber. der deutsch. Chem.-Ges.*, ix., 1115; *Journ. Chem. Soc.*, Nov., 1876, 530.) Crystallized veratrine was prepared by the authors according to the directions of Merck, partly from commercial veratrine and partly from veratrine made by themselves. The general properties of the substance accord with the statements of Merck and Weigelin respecting it. It melts at 205°. The numbers obtained by analysis (64·63 per cent. carbon, 8·68 per cent. hydrogen, 2·66 per cent. nitrogen) lead to the formula $C_{32} H_{50} N O_9$. The hydrochloride forms, with gold trichloride, the compound $C_{32} H_{50} N O_9 H Cl + Au Cl_3$, which crystallizes in yellow needles; with platinum tetrachloride, an indistinctly crystalline compound $(C_{32} H_{50} N O_9 H Cl)_2 + Pt Cl_4$; and with mercuric chloride, a white crystalline precipitate, $C_{32} H_{50} N O_9 H Cl + Hg Cl_2$. The sulphate $(C_{32} H_{50} N O_9)_2 H_2 S O_4$, and hydrochloride, are non-crystallizable.

Crystallized veratrine is insoluble in water, but on prolonged washing therewith it becomes transformed into a soluble modification, the solution of which leaves when evaporated a yellowish amorphous mass having the same composition as the crystals. Veratrine dissolved in water is rendered insoluble, and is consequently precipitated, by heating the solution. Acids also appear to convert the soluble into the insoluble modification.

Several samples of commercial veratrine examined by the authors were found to be almost pure.

Method for the Analysis of Alkaline Mineral Waters. Prof. R. Fresenius. (*Chem. Centr.*, Nov., 1876, 549, from *Zeitschr. für Analyt.-Chem.*, xv., 221–230.) The author publishes the following modified and improved process for the complete analysis of alkaline and ferruginous mineral waters:—

1. *Determination of Chlorine, Bromine, and Iodine mixed.*—About 2000 grams of water are evaporated on a water bath to one-quarter of its original bulk. The solution is filtered, washed, the filtrate acidified with nitric acid, precipitated with argentic nitrate, and the precipitate weighed either as such or after ignition in a stream of hydrogen.

2. *Determination of Silicic Acid, Iron, Manganese, Alumina, Lime, and Magnesia.*—About 7000 grams of water are acidified and evaporated to dryness in large platinum dishes. The residue is moistened with hydrochloric acid, water added, the solution warmed, and the silicic acid filtered off and washed. After weighing, the silica is ignited with ammonium fluoride and sulphuric acid. Any non-volatile substances are deducted. The silicic acid filtrate is treated with ammonia, and the precipitate is filtered after warming, and then washed. The latter (mostly hydrated ferric oxide) is dissolved in hydrochloric acid, neutralized with ammonium carbonate, boiled and filtered. Should ammonia give a precipitate in the

filtrate, it is filtered separately, dissolved, and reprecipitated. The filtrates are put together. The two precipitates are again dissolved, the solution treated with chemically pure alcohol (free from alumina), ammonia added, and the iron precipitated with ammonium sulphide. Having thus separated the iron from the alumina and the phosphoric acid, the ferrous sulphide precipitate is dissolved in hydrochloric acid, the solution oxidized with nitric acid, precipitated with ammonia, and weighed after ignition as ferric oxide. The filtrate from the sulphide is evaporated to dryness in a platinum dish, with addition of a solution of sodium carbonate, and the residue is heated with nitre. After moistening with water it is dissolved in hydrochloric acid, and the solution is filtered and precipitated with ammonia. Traces of a flocculent precipitate of aluminum phosphate are generally obtained. The filtrates containing the manganese, lime, and magnesia are concentrated; the manganese is precipitated with ammonium sulphide; the precipitate, after 24 hours, collected in a filter, redissolved and reprecipitated; the precipitate mixed with sulphur and ignited in a stream of hydrogen; and the manganese weighed as sulphide. The filtrates are evaporated with hydrochloric acid, the sulphur filtered off, and the lime precipitated in the filtrate with ammonia and ammonium oxalate. The precipitate is redissolved and reprecipitated, and finally weighed either as carbonate or oxide. The filtrates are evaporated to dryness; the ammonia salts expelled by ignition; the residue is moistened with hydrochloric acid and evaporated to dryness, again taken up with hydrochloric acid and water; and the magnesia is precipitated with sodium phosphate and weighed as pyrophosphate.

3. *Determination of the Sulphuric Acid and the Alkalies.*—About 3000 grams of the water are acidified with hydrochloric acid, evaporated, and the silicic acid filtered off, as in No. 2. The filtrate, which must not contain much hydrochloric acid, is precipitated at the boiling heat by carefully adding barium chloride. The precipitate is first weighed, then warmed with hydrochloric acid, and thoroughly washed. The solution is evaporated to dryness with a few drops of barium chloride solution, dissolved in water, filtered, and the precipitate weighed with the former. The last weight is regarded as the more accurate. The filtrate is evaporated to dryness, the residue taken up with water, and the solution boiled with addition of pure milk of lime. The filtrate is precipitated with ammonium carbonate and oxalate. The filtrate from the precipitate is evaporated to dryness, the ammonia expelled by ignition in a platinum dish, and the separation of the magnesia repeated, using very small

quantities of the reagents. After expulsion of the ammonia-salts the alkaline chlorides are obtained. In order to separate the potassium chloride from the sodium and lithium chlorides, all three are converted into platino-chlorides, and the dry precipitate, after treatment with alcohol of 80 volumes per cent., is filtered and washed with alcohol. The potassium salt having been transferred to a small tared platinum capsule, the remainder in the filter is dissolved in boiling water, evaporated to dryness, and weighed at 130°. To test the purity of the potassium-platino-chloride, it is again treated with water, platinum chloride, and alcohol, as above mentioned. The last weight is regarded as the more accurate. The quantity of sodium chloride is obtained by deducting the quantity of potassium chloride and lithium chloride (determined by the method described below) from the total sum of alkaline chlorides. Traces of alkaline earths, if present, must be determined and deducted from the total alkaline chlorides.

4. *Determination of the Carbonic Acid.*—The process as described in *Anleitung zur quant. Analyse*, 6 Aufl., p. 436. etc., is used.

5. *Determination of the Solid Residue.*—About 500–1000 grams are evaporated in a tared platinum dish on a water bath, and the residue is dried at 180°, and weighed. It is treated with water and hydrochloric acid, then with excess of sulphuric acid, evaporated to dryness, and ignited for some time with addition of solid ammonium carbonate, so as to convert the acid sulphates of the alkalies in neutral sulphates (till constant in weight). The solid residue of ferruginous waters is best determined with the water of bottles into which the iron has been completely deposited as hydrated ferric oxide by the action of the air. The solution is filtered, and the filtrate treated as in the preceding case. The precipitate is dissolved in nitric acid; silicic acid, if present, is determined and added. The nitric acid solution is evaporated, the residue ignited, treated with water and ammonium carbonate, then heated moderately, and weighed; and the weight is added to that obtained by weighing the solid residue of the filtrate at 180°. The ferric oxide, etc., is treated with nitric and sulphuric acids, evaporated and ignited. The weight obtained is added to the weight of sulphates.

6. *Determination of Iodine, Bromine, Lithium (Manganese), Barium, and Strontium.*—About 60 litres are evaporated in a tinned copper still to about 4 or 5 litres, the alkaline liquid is filtered, and the residue washed with hot water until the washings are free from alkali. The residue is also treated until a lithium line is no longer visible in the spectrum. The solution (*a*) serves for determining

iodine, bromine, and lithium; and the residue (*b*) for determining the (manganese) barium and strontium.

(*a*) *The solution* is evaporated and alcohol (95 per cent.) added, with constant mixing; the filtered residue is boiled three times with the alcohol, and the alcoholic solution is distilled over, with addition of two drops of strong potash ley. The residue is dissolved in water, evaporated, and again treated with alcohol of 96 per cent. The solution is redistilled, and the residue again treated as above. An alcoholic solution is thus obtained which contains all the iodine and bromine, but only traces of alkaline chloride. The solution is evaporated in a platinum dish with addition of two drops of potash ley, and the residue, after gentle ignition, is extracted with boiling water. If the solution be coloured brownish it is again evaporated with two drops of potash ley and a small quantity of nitre, and the residue is again heated moderately. The solution, now colourless, is treated with carbon bisulphide, and acidified with dilute sulphuric acid; a small quantity of a solution of nitrous acid in sulphuric acid is then added, with agitation, and the violet coloured carbon disulphide is washed out.

The iodine is determined in this liquid with a very dilute solution of sodium thiosulphate. From the solution left after washing out the iodiferous carbon disulphide, bromine and chlorine are precipitated in the form of silver compounds, and the bromine is determined by deducting the weight obtained by heating weighed quantities of the bromo-chloride of silver in a stream of chlorine. The filtrate from the silver compounds is treated with hydrochloric acid, and filtered, and the filtrate is set aside.

For the determination of lithium (1), the three residues left by the treatment with alcohol (2), the two incinerated filters through which the solution (free from organic matter) of the alkaline metals was filtered, and (3) the solution which was obtained after separating the excess of silver are used. The three are mixed together with water, and then hydrochloric acid is added, and the solution evaporated. The residue is treated with absolute alcohol and filtered, and the residue is boiled with small quantities of strong alcohol, until either the residue of sodium chloride, or the evaporated residue of the last alcoholic extract no longer gives a lithium spectrum. The alcoholic filtrates are distilled off, the residue dissolved in water, with addition of two drops of hydrochloric acid, the solution is evaporated, and the treatment with absolute alcohol twice repeated, adding to the last alcohol used half its volume of ether, and always testing the residues by the spectrum. The ethereal-alcoholic solution is now distilled off; the residue moistened with water; hydrochloric acid added; the liquid again evaporated to dryness; the residue taken up with water; and to remove small portions of phosphoric acid which may have gone over into the solution, two drops of iron solution are added. Pure milk of lime is next added in slight excess, the mixture boiled, and the precipitate (mainly magnesium hydrate) filtered, and washed with hot water until it no longer shows a lithium reaction. The filtrate is precipitated with ammonium oxalate, and the precipitate washed, ignited, dissolved, evaporated, and tested for lithium. If a reaction be still obtained, the solution is again precipitated and filtered. The filtrate or filtrates are evaporated to dryness, the ammonia salts expelled; the residue moistened with hydrochloric acid; water added; the solution evaporated to dryness on a water bath, and the treatment with milk of lime, etc., repeated, using small quantities of the reagents, and constantly testing the separated precipitates for lithium. Having expelled the ammonia salts a second time, moistened with hydrochloric acid and evaporated, the lithium is separated as lithium phosphate, according to the method mentioned in *Zeitschr. analyt. Chem.*, i., 42. The precipitate is then dissolved in hydrochloric acid, and tested to find out whether the dilute solution gives with excess of ammonia a small precipitate in the cold. If such be the case, it is redissolved in hydrochloric acid, precipitated with ammonia, filtered, weighed, and deducted from the lithium phosphate obtained. The filtrate from the phosphate is tested for caesium and rubidium.

(*b*) *The residue insoluble in water* is treated with water in a large porcelain dish, and hydrochloric acid (with five drops of sulphuric acid) added. Solids adhering to the copper still are removed by treatment with acetic acid, and the whole is evaporated to dryness. The residue is treated with hydrochloric acid and water; the silicic acid, etc., filtered off; the precipitate boiled with sodium carbonate until the silicic acid is dissolved; the solution filtered, and the residue washed, incinerated and fused with sodium carbonate.

The fused mass is boiled with water, filtered, washed, and dissolved in dilute hydrochloric acid; the solution is evaporated, and the residue is taken up with water and a few drops of hydrochloric acid. The solution is then precipitated with a few drops of dilute sulphuric acid, left to settle, filtered, and the filtrate is treated with three volumes of alcohol. If a precipitate is formed, it is strontium sulphate or calcium sulphate. The filtered barium sulphate is, after washing, brought into a funnel closed at the bottom by a tap, and treated with a concentrated solution of ammonium carbonate. After twelve hours the tap is opened, the liquid run out very slowly, the precipitate washed and treated with very dilute nitric acid, to remove any strontium mixed therewith; then washed with water, dried, ignited, and weighed as pure barium sulphate. The filtrate from the silicic acid is diluted with water, treated while warm with sulphuretted hydrogen, to remove traces of tin gone over into the solution; the filtrate is then boiled with nitric acid, the precipitate dissolved in hydrochloric acid, the ferric oxide separated by precipitation as basic salt, and the filtrate supersaturated with ammonia. In the solution, filtered, if necessary, the manganese is precipitated with ammonium sulphide, and the lime in the filtrate precipitated with ammonia and carbonate of ammonia. The filtered and washed precipitate is dissolved in nitric acid (adding the above-mentioned nitric acid solution containing strontium), and evaporated in a retort on a sand bath, exhausting the moisture by means of an air pump. The residue is then treated with not too large a quantity of ether and alcohol, so as to dissolve the nitrate of calcium. The residue is dissolved in water, evaporated to a small bulk, and a concentrated solution of ammonium sulphate (1 in 4) added in excess. After twelve hours the solution is filtered through a small filter (the above-mentioned strontium precipitate obtained by the treatment with alcohol is added to the same), and after washing with ammonium sulphate, dried and ignited as sulphate.

7. *Determination of the Phosphoric Acid.*—The phosphoric acid might be estimated in the determination of the ferric oxide, alumina, etc., in Nos. 2 and 6. It is best, however, to determine it in a separate portion of the water. About 6 litres are evaporated with hydrochloric acid, the silicic acid is separated, the filtrate evaporated with nitric acid to dryness, the residue dissolved in nitric acid and water, precipitated with a nitric acid solution of ammonium molybdate, and the phosphoric acid determined as pyrophosphate of magnesia.

8. *Determination of the Nitric Acid and Ammonia.*—If nitric acid and ammonia are present in determinable quantities, the method mentioned in *Anl. zur quant. Anal.*, 5 Aufl., pp. 696, 697, is used. If the water contains large quantities of organic substances, it is better to replace the soda ley necessary to expel the ammonia by magnesia.

Butter Analysis. Dr. J. Muter. (Abstracted from the *Analyst*, 1876, No. 1.) The process adopted by the author for the full analysis of butter is as follows :—

1. 1500 grains of the butter are placed in a counterpoised porcelain dish over a very low gas flame, and stirred with a thermometer at a heat not exceeding 230° F., until all the water is given off, which is indicated by effervescence entirely ceasing, and the curd and salt settling perfectly down to the bottom of the dish, leaving the absolutely clear melted fat. The whole is then cooled and weighed, and the loss calculated to percentage of *water*. This is the only method of absolutely and rapidly drying a fat, and the large quantity taken ensures a more perfect estimate of the true amount of water in the sample. The temperature of 230° has not the slightest influence on butter fat.

2. The fat is melted at a gentle heat and poured off as far as possible into a beaker, without disturbing the sediment. The remainder is poured on a weighed filter, placed over a beaker in the drying chamber, and when drained the basin and filter are rinsed with petroleum spirit, to remove all the traces of fat; and the filter being dried and weighed gives *curd* plus *ash*.

3. The filter after being weighed is placed in a weighed platinum crucible and gently ignited. This gives *ash* called *salt* in the report.

4. The fat poured off from No. 2—which will generally be about 1200 grains—if absolutely clear, is at once used for physical and chemical examination; but if *not* perfectly free from specks, it must be filtered through a Swedish filter kept hot on the water bath. The processes necessary are the taking the specific gravity of the fat at 100° F., and if that gives an adverse indication, the estimation of the total fatty acids of the butter fat, both soluble and insoluble.

Determination of the Specific Gravity.—A 1000 grain bottle is procured with rather a pear-shaped neck, and fitted with a thermometer stopper ranging from 32° to 140° F. The long mercurial bulb comes exactly down the centre of the bottle, and the scale is up above the stopper. The bottle is placed on the balance, and an accurate counterpoise prepared for it. It is then filled with recently boiled distilled water, at 95° F. The stopper is inserted and the whole at once plunged up to the neck into a 12 oz. squat beaker partially filled with distilled water at 103° F., in which is placed a thermometer. As the temperature rises in the bottle, the water leaks out at the stopper, and in a few minutes (if the quantity of water in the beaker be properly regulated) a time arrives when the temperature of both thermometers equalize themselves at 100°. The point between the stopper and the bottle is instantly wiped with a small piece of filter paper, to absorb loose water; and the bottle is lifted out, thoroughly cleansed, and weighed. By repeating this three times the actual contents of the bottle at 100° F. is obtained, and the weight taken before a fall of more than 5° takes place. This weight of water is scratched on the bottle with a diamond, and all is ready for the butter. The pure butter fat, prepared as already described, is taken from the bath and cooled to 95° F.; it is then poured into the bottle, and the whole operation repeated *thrice*, exactly as with the water, and the mean of the three weighings thus obtained is divided by that of the water. The contrivance of having a "*rising*" fat heated by "*falling*" water until the two equalize, is the height of accuracy, and moreover gives an appreciable rest in the variation of the temperature sufficient to enable the excess of fat which has leaked out to be removed exactly at the required temperature.

In the author's opinion, any butter showing a specific gravity of over ·911 may be safely passed over without analysis, as being good.

The Total Fatty Acids.—About 10 grams (or 150 grains) of the butter fat at 100° F. are weighed by difference from a suspended tube into a clean, dry, 15 ounce flask, and 5 grains of potassium hydrate, with two fluid ounces of rectified spirit, are added. The flask is placed in a basin with hot water, and kept boiling for a considerable time, until on adding water not the faintest turbidity occurs. Ten ounces of water are added, and evaporation continued (just short of boiling) until all traces of alcohol are dissipated. The contents of the flask are then made up to 7 ounces with nearly boiling water; and a good fitting cork having been introduced, through which just passes a tube 2 feet long and ending in a small funnel, 5 grams of full strength sulphuric acid are poured in down the tube, followed by some water. The whole is then agitated with a circular motion until the soap, which rises suddenly, is changed into a perfectly clear and transparent stratum of fatty acids. The flask and contents are then cooled down to 40° F., till a perfectly solid cake of fatty acid forms. A few drops of cold water are run in to wash the tube, and the cork having been removed, a small piece of fine cambric is placed over the mouth of the flask, held *in situ* by an ordinary indiarubber ring. The fat cake is caused to detach itself from the sides of the flask by a gentle movement, and then the filtrate is decanted, without breaking the cake, into a litre test mixer with a good stopper. About an ounce of cold water is poured into the flask through the cambric, and the whole cake and flask rinsed out by gently turning round, and the washings added to the filtrate. Six ounces of water at 120° are now added through the muslin, which is then quickly detached, and the cork and tube inserted. The whole is again heated, this time to 200°, and kept constantly agitated with a circular but not a jerky motion for five minutes. This agitation so divides the fat that it almost forms an emulsion with the water, and is the only means of thoroughly and rapidly washing fatty acids without loss. In practice no butyric acid comes off at 200°; but any trace that might do so is caught in the long tube. The cooling and filtering are then again proceeded with as above described (the filtrate being added to the contents of the test mixer), and the washings are repeated alternately cold with 1 ounce, and hot with 6 ounces of water, until they do not give the slightest change to neutral litmus. After thoroughly draining the residual cake by letting the flask stand upside down for some time, the cambric is removed and the flask is laid out on its side in the drying oven with a support under the neck, until the acids are thoroughly fused, when they are poured while hot into a tared platinum capsule, dried, and weighed. The film of fatty acid still remaining on the flask is rinsed out with ether, and dried in a small weighed beaker, and the weight added to the whole. If any drops of water be observed under the fatty acids in the capsule after an hour's drying, the addition of a few drops of absolute alcohol will quickly cause them to dry off. If any trace of fat is on the cambric, it should be also dried and extracted with ether; but with care not to break the cake at the last pouring off this does not occur.

The process is absolutely accurate, and the merest tyro cannot make any loss so long as he does not deliberately shake the melted acids against the cork, which he could not do if he practises a circular agitation while washing. The filtrate in the test mixer is now made to an absolute bulk, and in 200 c.c. the total acidity is taken with a weak solution of sodium hydrate. The solution generally used represents ·01 of NH_3 in each c.c., as it serves also for nitrogen combustions; but a useful strength would be decinormal soda, containing ·004 $NaHO$ in each c.c. The acidity found is multiplied by five, calculated to H_2SO_4, and noted as "total acidity as H_2SO_4." 100 c.c. are next taken and precipitated with barium chloride in the presence of a strong acidulation with hydrochloric acid, well boiled, and washed by three decantations, boiling each time; and, lastly, on a filter, till every trace of soluble barium is removed. The precipitate is dried, ignited, and weighed as usual, multiplied by ten, and calculated to H_2SO_4, and noted as "total sulphuric acid." Lastly, 100 c.c. are evaporated to dryness over the water bath in a tared platinum dish holding 120 c.c., and furnished with a cover of platinum foil, also tared. When dry the dish is covered and heated over a bunsen till all fumes cease; and a fragment of pure ammonium carbonate having been added, the whole is again ignited and weighed. The amount of potassium sulphate found is multiplied by 10 and calculated to H_2SO_4, and noted as "combined sulphuric acid." The rest of the calculation is obvious from the following example:—

Ten grams taken.

Total acidity as H_2SO_4	0·814
Total H_2SO_4	4·9
Combined H_2SO_4	4·4

$4{\cdot}9 - 4{\cdot}4 = {\cdot}5$ free H_2SO_4

$0{\cdot}814 - {\cdot}5 = {\cdot}314$ acidity due to butter acids stated as H_2SO_4

Then $\frac{{\cdot}314 \times 176}{98} = {\cdot}564$ butyric acid in 10 grams taken, which equals 5·64 per cent.

The author regards 88 per cent. of insoluble fatty acid as a fair standard of butter calculation, if associated with at least 6·3 of soluble acids. But he would not apply any charge of admixture to a butter which showed less than 89·5 insoluble with 5 of soluble acids.

Butter Analysis. A. Dupré. (From a paper read before the Society of Public Analysts, June 14th, 1876.) On the strength of numerous experiments, the author has adopted the following method, which in his opinion leaves nothing to be desired on the score either of facility of execution or of accuracy:—About 5 grams of the dry filtered butter fat are weighed into a small strong flask; 25 c.c. of a normal alcoholic soda solution are added; the flask is closed by means of a well-fitting caoutchouc stopper, firmly secured by a piece of canvas and string, and heated in a water bath for about one hour. When cool the flask is opened, the contents—which are semi-solid—carefully liquefied by heat and washed into a flask with hot water. This flask is now heated for some time on a water bath to expel the alcohol, some more hot water is added, and 25 c.c. of diluted sulphuric acid, somewhat stronger than the alkali used, are run in. The contents are allowed to cool, and the acid aqueous solution below the cake of fatty acids is passed through a filter. The fatty acids in the flask are washed by hot water in the manner recommended by Dr. Muter, *i.e.*, each time allowed to cool; all the washings are passed through a filter. The author uses no cambric, but passes everything through paper. With care scarcely any of the fatty acid will find its way into the filter. After the washing with water is completed and the flask drained, he washes any fatty acid that may be on the filter into the flask by means of a mixture of alcohol and ether on a water bath, and finally dries the fatty acids in the flask at a temperature of 105° C. The drying can be done readily if the melted fat is now and then shaken briskly, so as to sub-divide the water as much as possible. In this way the acids, when once in the flask, are not taken out until their weight has been taken, thus reducing the risk of loss to a minimum. Meanwhile the acidity of the aqueous filtrate and washings is estimated by decinormal soda solution. Subtracting from the amount required the proportion necessary to neutralize the excess of acid added in decomposing the soap, the rest represents the soluble fatty acids contained in the butter taken, and on the assumption of its being butyric acid we can, of course, calculate the amount of this acid present. When once the equivalent of the soluble acids present in butter is fairly determined, this, of course, will have to be substituted for that of butyric acid. The results thus obtained are very accurate, and the process is very simple in execution. The author has satisfied himself by repeated experiments that the alkalinity of the alcoholic soda solution by itself is not altered by the process.

The author places no reliance on the specific gravity test, as he finds that mutton dripping, and other fats likely to be used as adulterants of butter, may acquire a sp. gr. above ·911 by being strongly and repeatedly heated. He thinks, however, that any sample of butter showing a sp. gr. below ·911 may safely be pronounced adulterated.

In a subsequent note, Dr. Dupré states that he has effected the saponification, decomposition of the soap, and the washing and drying of the fatty acids at ordinary temperature, thus still further reducing the risk of breaking up the higher into lower acids. The saponification is readily effected by using a sufficiency of alcoholic soda. Between four and five grams of the dry butter fat were shaken up for several minutes with 100 c.c. of normal alcoholic soda. The butter soon dissolves, but after a time the solution gelatinises to a clear, transparent jelly. (The temperature of the laboratory at the time of these experiments ranged between 22° and 50°). This jelly is now allowed to stand over night, during which time the smell of butyric ether, very strong at first, entirely disappears. In one of the experiments the alcohol was allowed to evaporate spontaneously, before the acid was added; in the other (made with a different sample of butter), the soap was dissolved in about a half-litre of water, and at once decomposed by the addition of hydrochloric acid. The fatty acids, which separated in white curdy masses, were thoroughly washed on a filter with cold water, about four litres, dried in vacuo over oil of vitriol, and weighed. The results of experiment show that butter fat yields the same proportion of insoluble fatty acids, whether saponified with or without the aid of heat.

The Preparation of Nicotine. W. Kirchmann. (*Archiv der Pharm.* September, 1876, 209.) The author proposes the following simple method of preparing pure nicotine. A tin vessel, provided with two tubulures, is filled with tobacco, which is previously damped with sodium carbonate. One of the tubulures admits a glass tube reaching nearly to the bottom of the vessel; the other is provided with a glass tube merely penetrating the cork. The vessel is made air-tight, placed into a boiling hot steam bath, and a rapid stream of carbonic acid gas passed through it, entering the vessel by the longer, and leaving it by the shorter tube; the latter dips into a mixture of alcohol and dilute sulphuric acid. In this manner a large yield of perfectly colourless nicotine sulphate is obtained. In order to obtain the pure alkaloid, caustic baryta is added to the solution, the latter evaporated to dryness, and the pure nicotine extracted with ether.

A portion of highly concentrated solution of acid nicotine sulphate (bisulphate), saturated with alumina hydrate, deposited in a short time handsome octahedric crystals, which the author considers to be nothing else but nicotina alum, although he adds that he is not aware of a previously-known case where a tertiary diamine base could take the place of ammonia in alum.

The same process could probably be employed for the preparation of conia (from *Conium maculatum*, L.; hemlock) and sparteïna (from *Spartium scoparium*, L. = *Cytisus scoparius*, Link., *Sarothamnus scoparius*, Wimmer; broom.)

The Essential Oil of Cubebs. A. Oglialoro. (*Journ. Chem. Soc.*, from *Gazetta Chim. Ital.*, v., 467.) Whilst examining a specimen of essence of cubebs, the author found that he obtained a hydrocarbon, $C_{10} H_{16}$, boiling at 160°, which appears to have been unnoticed by any previous experimenter, although he did not succeed in separating the hydrocarbon of boiling point 230°, mentioned by Schmidt. This induced him to prepare some of the essential oil from cubebs by distilling the substance in a current of steam in a copper still; the yield was about four per cent., and the product, when submitted to careful rectification after being dried over calcium chloride, yielded a small quantity of a hydrocarbon, $C_{10}H_{16}$, belonging to the terpene series, boiling at 158°–163°, and a considerable portion boiling at 250°–270°,—evidently a mixture,—but no trace of the hydrocarbon boiling at 230°, observed by Schmidt.

The portion boiling at 250°–270° was mixed with half its weight of ether and saturated with hydrochloric acid; by this means a crystalline hydrochloride, of the composition $C_{15}H_{24}HCl$, was separated; whilst the mother-liquor, after evaporation of the ether and separation of a further portion of the hydrochloride which crystallized out, was washed with dilute alkali, dried, and submitted to fractional distillation. The greater portion passed over at 262°–263°, and possessed a slight lævorotatory power, although it is doubtful whether this is inherent in the hydrocarbon, or is due to the admixture of a small amount of that which forms the crystalline hydrochloride. The hydrochloride crystallizes from boiling alcohol in long colourless needles, which melt at 117°–118°: and when heated for some time to 170°–180° with water in sealed tubes, is completely decomposed into hydrochloric acid and a hydrocarbon of the formula $C_{15}H_{24}$. This, after purification by rectification from sodium, has a density of 0·9289 at 0°, and boils at 264°–265°. It deflects the polarized ray to the left. The hydrochloride also has considerable action on polarized light.

The Fluorescent Matter in Atropa Belladonna. R. Fassbendeo. (*Zeitschr. des oesterr. Apoth. Ver.*, xi., 506; *Pharm. Zeit.* [3], vii., 596.) The author publishes some further information respecting the blue fluorescent matter discovered by Richter. It is found in all parts of *Atropa belladonna*, and is distinguished by its great permanence and very strong fluorescence, which can be recognised even when extremely diluted. The author found it in all the commercial extracts of belladonna he examined; whether commercial specimens of atropa and it salts are free from this substance, he is not in a position to state.

In order to show how extremely small a quantity of this substance can be distinctly recognised, the author crushed two unripe belladonna berries in some water, evaporated the liquor in a water bath, treated the residue with alcohol, filtered, evaporated the solution, and again dissolved the residue in water. The filtered solution, which perceptibly reddened blue litmus paper, was digested with animal black, which absorbed the colouring matter; the charcoal was treated with alcohol at a gentle heat, a few drops of ammonia added, the liquor filtered, and the charcoal again washed with alcohol. The filtrate was clearly fluorescent, and when diluted with 200 c.c. of alcohol, the characteristic blue colour was still distinctly perceptible if looked at from above. The great permanence of this substance may be shown with a few drops of a less dilute solution mixed with a drop of ammonia on a watch glass; after the rapid drying up of this liquid upon a warm day, the reaction is reproduced by the addition of more ammonia. Besides the colouring matter, there is obtained by the above method of preparation a yellow resinous body, insoluble in water and very soluble in alcohol.

A New Reagent for Glucose. A. Soldaini. (*Ber. der deutsch. Chem.-Ges.*, ix., 1126.) The author recommends a solution of potassio-carbonate of copper as a test for glucose. The reagent is prepared by dissolving 15 grams of precipitated carbonate of copper gradually, with the aid of heat, in a solution of 416 grams of bicarbonate of potassium in 1400 c.c. of water. It keeps well and undergoes no change, even on prolonged boiling. It is reduced by glucose and sugar of milk, but not by pure cane sugar, dextrin, or starch. Tartaric acid, uric acid, and normal urine do not affect it; but tannic and formic acid, when heated with it, effect a separation of cuprous oxide.

Occurrence of Glucose in Spirit of Wine. G. Salomon. (*Chem. Centralbl.*, No. 33.) Commercial alcohol has been observed to leave on evaporation a residue which reduces Fehling's solution. In one instance the author obtained from one litre of spirit 0·13 gram of glucose, emanating probably from liquors previously kept in the same cask. A knowledge of the occurrence of this impurity may be important in analytical investigations.

Taxine, a Poisonous Alkaloid contained in the Leaves and Seeds of Taxus Baccata. W. Mavine. (*Chem. Centralbl.*, 1876, 166; *Journ. Chem. Soc.*, April, 1877.) Although cases of poisoning by yew berries have been confirmed in former times, and also recently, the poisonous effects of the fruit and seeds of the yew tree are disputed from many sides, while the strongly toxic action of the other portions of the tree are known generally.

Lucas isolated from the leaves of this tree three grains of a body which he called taxine, and gave a few reactions regarding it. For its preparation Stass's method for detecting alkaloids was followed out, without giving satisfactory results. The following process was more successful:—The leaves or seeds are powdered, and repeatedly exhausted with ether; the extracts are mixed, and the ether is distilled off. The residue, which when obtained from the leaves forms a green resinous mass, having a peculiar aromatic smell and sharp taste, while that from the seeds is a large quantity of a fatty oil, was repeatedly shaken up with water, acidulated, and slightly warmed. The water separated from the residue was filtered, and in the clear and colourless filtrate the taxine was precipitated by ammonia or fixed alkali, in snow-white bulky flakes. When washed and dried over sulphuric acid, it forms a white crystalline powder, which is scarcely soluble in distilled water, readily soluble in acidulated water, alcohol, ether, chloroform, benzin, and carbon disulphide; and insoluble in petroleum ether. In has no smell, but a very bitter taste. Pure, concentrated sulphuric acid reddens it; nitric, hydrochloric, and phosphoric acids dissolve it without change of colour. With most of the reagents characteristic of alkaloids—tannic acid, phosphomolybdic acid, potassio-mercuric iodide, potassio-cadmic iodide, potassio-bismuthic iodide, iodo-potassio iodide, potassio-argentic cyanide, potassic bichromate, picric acid — it yields, in an acid solution, amorphous precipitates. Platinic chloride, auric chloride, mercuric chloride, potassio-platinous cyanide are not precipitated. It does not form crystallized salts with the ordinary acids. It is nitrogenous (evolves ammonia when heated with freshly ignited soda-lime), melts at 80°, and burns without residue when heated more strongly. Taxine is present in the leaves in larger quantities than in the seeds of the yew tree.

The Dissociation of the Vapour of Calomel. H. Debray. (*Comptes Rendus*, lxxxiii., 330.) Odling and Erlenmeyer regard the dissociation of the vapour of calomel at 440° C. as complete, and base their opinion on the density of the vapour and the observation that a strip of gold placed in the vapour becomes amalgamated and also coated with an incrustation of mercuric chloride. This view, however, is not borne out by the author's experiments. If it be assumed that the vapour at the temperature named represents a mixture of equal volumes of the vapour of mercury and mercuric chloride, the tension of the vapour of mercury in this mixture would amount to half an atmosphere; and unless the tension of dissociation of gold amalgam is proved to be less than half an atmosphere, the author declines to regard the experiment with the strip of gold as conclusive. If it be more than half an atmosphere, the gold could not amalgamate in such a mixture. His own experiments show that a strip of gold heated to 440° is not amalgamated in the vapour of mercury at the ordinary atmospheric pressure; and that on heating calomel to the same temperature, and placing a curved gilt silver tube, through which cold water is kept running, into the vapour for a few seconds, the tube becomes coated with calomel intermixed with a small quantity of metallic mercury. He therefore arrives at the conclusion, that though some decomposition takes place, the dissociation at 440° is not complete.

Ostruthin. E. von Gorup-Besanez. (*Liebig's Ann. d. Chem.*, clxxxiii., 321–343; *Amer. Journ. of Pharm.*, May, 1877.) This body was discovered by the author in 1874, in the root of *Imperatoria ostruthium.* The following is an outline of the process by which the largest yield has been obtained :—

The young roots of masterwort, one to two years old, are cut and digested with 90 per cent. alcohol at 50° to 60° C., until the liquid ceases to become coloured; the mixed tinctures are distilled to one-third, and this then evaporated until on cooling a thick liquid remains. This residue is exhausted by a mixture of three parts of ether and one of ligroin of low boiling point, until a firm plaster-like mass remains. The solution is mixed with more ligroin, which separates a brown sticky mass, and the decanted liquor is evaporated spontaneously from flat dishes, and if necessary decanted from the oily sediment forming. Yellow crystals are afterwards deposited, which are freed from adhering resinous matter by spreading them upon porous plaster tiles. The crystals are then dissolved in ether, the solution again mixed with some ligroin, freed from the deposited oily matter, and evaporated spontaneously. Repeated recrystallization from ether yields larger but still yellow crystals, which are obtained white by dissolving them in alcohol and adding water until a permanent precipitate begins to appear.

Ostruthin crystallizes from ether in the triclinic system, the crystals resembling rhombohedrons. It fuses at 115° C., and congeals at 91° C. to a wax-like mass, becoming crystalline; it is inodorous, tasteless, burns with a bright smoky flame, and yields by dry distillation a thick yellowish oil, with an odour resembling Canada balsam. It is insoluble in cold water, sparingly soluble in benzol and petroleum benzin, and freely soluble in alcohol and ether. The alcoholic solution has a faint blue fluorescence, which becomes magnificently blue on the addition of water; more water precipitates it. All its solutions are neutral and optically inactive. It composition is $C_{14} H_{17} O_2$.

Ostruthin hydrochlorate, $C_{14} H_{17} O_2 H Cl$, is obtained by passing muriatic acid gas into a not very dilute alcoholic solution of ostruthin, which congeals; the mass is then washed with water and crystallized from ether. It forms white, tasteless, and inodorous needles, soluble in alcohol, ether, benzol, and chloroform; less so in petroleum benzin.

Ostruthin hydrobromate is prepared in the same way; but in attempting to crystallize from ether it was decomposed, bromine being liberated. A combination with hydriodic acid could not be obtained, owing to the liberation of iodine. Among the products of decomposition obtained by adding ostruthin to fusing potash, resorcin was found. Treated with strong nitric acid, it is first converted in a resinous body, and finally into oxalic acid; but when boiled for a long time with nitric acid, diluted with three parts of water, it yields styphinic and a little oxalic acid.

Chlorine yields with difficulty, bromine more readily, substitution compounds.

Volumetric Estimation of Astringent Principles. F. Jean. (*Compt. Rend.*, lxxxii., 982.) Tannic and gallic acids, and other astringent substances, after the addition of an akaline carbonate, energetically absorb iodine from its solution; and this absorption takes place in direct proportion to the quantity of the astringent matter present. For the estimation of such substances the author employs a 0·4 per cent. solution of iodine in potassium iodide, and this is titrated by means of a standard solution of tannin in sodium carbonate. Under the influence of the iodine the tannin solution acquires an intense orange red colour, which would prevent the starch test being applied as an indicator of the presence of free iodine, if this test were applied in the ordinary way. But the author rubs powdered starch over white filter-paper, and when a minute drop of the deeply coloured liquid is placed on the paper, it is instantly absorbed, while the characteristic violet stain due to the free iodine remains. As decoction of oak bark is found to contain no principle other than tannin, which is capable of exercising this action on iodine, the method is directly available for testing barks intended for tanning purposes.

Ferric and Aluminic Phosphates. M. Millot. (*Journ. Chem. Soc.*, from *Comptes Rendus*, lxxxii., 89.)

Ferric Phosphate.—$2\,P_2O_5.\,Fe_2O_3.\,8\,H_2O = Fe_2P_4O_{13}.\,8\,H_2O$.—This phosphate is obtained when ferric hydrate or oxide is dissolved in hydrated phosphoric acid, either cold or hot. If an insufficient quantity of phosphoric acid is employed, the mass hardens, and more phosphoric acid must be added till it remains pasty. Water is added and the liquid is filtered. On addition of water to the washings, the phosphate, $3\,P_2O_5.\,2\,Fe_2O_3.\,8\,H_2O$, is deposited. The mass left on the filter, after purification, has the formula, $2\,P_2O_5.\,Fe_2.\,O_3.\,8\,H_2O$.

The anhydrous salt is prepared by fusing ferric oxide with an excess of phosphoric acid, and removing the excess by washing. If a high temperature be employed, part of the product becomes insoluble in acids, but does not vary in composition from the portion which dissolves. The hydrated phosphate dissolves in ammoniacal ammonium citrate, and in alkalies and their carbonates, but is insoluble in acetic acid. The precipitate obtained on adding water to the filtrate from the preparation of the above-mentioned phosphate is white and crystalline. Its formula is $3\,P_2O_5 . 2\,Fe_2O_3 . 8\,H_2O = Fe_4P_6O_{21} . 8\,H_2O$. It is more easily prepared by heating a solution of ferric sulphate with dihydric ammonia orthophosphate, thus:—

$$6\,(NH_4)H_2PO_4 + 2\,Fe_2(SO_4)_3 = Fe_4P_6O_{21} . H_2O + 6\,(NH_4)HSO_4.$$

The liquid is filtered white hot, and the precipitate is washed with boiling water. When ignited it turns to a greyish blue mass, which dissolves easily in acids. Its properties are similar to the preceding one.

Aluminic Phosphate—$2\,P_2O_5 . Al_2O_3 . 8\,H_2O = Al_2P_4O_{13} . 8\,H_2O$.—This salt cannot be prepared in the same manner as the corresponding iron salt, owing to the solubility of alumina. It may be obtained by treating the phosphate, $Al_4P_6O_{21} . 16\,H_2O$, with two equivalents of phosphoric acid; it is dried, washed, and the treatment repeated. It may be obtained in the anhydrous state by igniting a salt of alumina with excess of phosphoric acid, and washing out the metaphosphoric acid formed, with water. The product is partially insoluble in acids.

$$3\,P_2O_5 . 2\,Al_2O_3 . 16\,H_2O = Al_4P_6O_{21} . 16\,H_2O.$$

This phosphate is obtained when two equivalents of aluminum sulphate and six equivalents of dihydroammonic orthophosphate are boiled together, thus:—

$$2\,Al_2(SO_4)_3 + 6\,H_2(NH_4)PO_4 = Al_4P_6O_{21} . 3\,H_2O + 3\,(NH_4)HSO_4.$$

The precipitate is filtered and washed with boiling water, for it is soluble in cold water. Free sulphuric acid must be present during its preparation, or it will contain excess of alumina. This salt is formed when commercial superphosphates are washed with water. When ignited it becomes partially insoluble in acids:—

$$2\,P_2O_5\ 3\,Al_2O_3 . 8\,H_2O = Al_6P_4O_{19} . 8\,H_2O.$$

If an acid solution of one of the previously-described phosphates is precipitated with ammonia, taking care not to add sufficient to dissolve it, this phosphate is produced. When ignited it dissolves in acids.

All these phosphates are hygroscopic; they are all insoluble in acetic acid, but dissolve in ammoniacal ammonium citrate, ammonium oxalate, alkaline carbonates, and ammonia; those of alumina dissolve much more easily than the corresponding iron salts.

A Hydrate of Cellulose. A. Girand. (*Zeitschr. des oesterr. Apoth. Ver.*, 1876, 557, from *Comptes Rendus.*) Besides the normal cellulose as it is obtained from the organs of plants, and the gelatinous modification of the same mentioned by Bechamp in 1856, there is known to exist another peculiar, not very distinctly characterized variety of this substance, the formation of which is frequently observed in industrial operations. The cellulose in this state appears to have lost its firmness and become friable. In submitting this body to a closer examination, the author recognised it as the first modification produced from cellulose by the action of acids. In preparing it the conditions requisite for its formation must be scrupulously observed; the acid must be of a definite strength, and must be allowed to act on the cellulose at a definite temperature and for the exact time required. Pure cotton wool is moistened with water, then introduced into cold sulphuric acid of 1·450 specific gravity, and left in contact with it for about 12 hours. At the expiration of this time the fibres appear but little altered, but when pressed between two glass plates they break up into a multitude of small, irregular fragments. Notwithstanding its friability, this substance can be readily washed and dried at a low temperature without losing its shape. In the dry state, however, it crumbles between the fingers to a fine snow-like powder. The numbers obtained in its ultimate analysis lead to the formula $C_{12}H_{22}O_{11}$, which represents it as a monohydrated cellulose. It does not part with its molecule of water on drying.

Hydrocellulose, as the author calls this substance, possesses definite characteristic properties. It is readily oxidizable; heated to 50° C. for several days it gradually turns yellow, while its per centage of oxygen increases and that of its carbon diminishes. If it now be washed with water, it yields to the latter a coloured substance which reduces both Fehling's solution and silver nitrate; but the insoluble residue is nothing but unaltered hydrocellulose, $C_{12}H_{22}O_{11}$. Heated with a 1 per cent. solution of caustic potash it is gradually dissolved, with the formation of a strongly coloured liquid possessing reducing properties.

The formation of a friable hydrocellulose as an intermediate product between cellulose and glucose seems to throw light on certain industrial processes which were hitherto but little understood. The production of parchment paper, for instance, may be attributed to a superficial conversion of the paper fibre into hydrocellulose. These fibres adhere closely and firmly together, thus closing the pores of the paper and making it impermeable. If the action of the acids is allowed to proceed too far, or if the washing is done imperfectly, the whole of the fibres are then changed in this manner, and the paper becomes flawy. Possibly the mellowing of paper and of cloth, due to an imperfect removal of the bleaching agents by washing, may also be explained as the result of the formation of hydrocellulose. The chlorinated lime, being decomposed by the carbonic acid contained in the air, forms hypochlorous and hydrochloric acid, by the action of which on the cellulose the latter may be partially converted into hydrocellulose.

The Constituents of Balsam of Tolu. E. Busse. (*Ber. der deutsch. Chem.-Ges.* ix., 830; *Journal Chemical Society*, Dec., 1876, 640.) Somewhat contradictory results have been arrived at by Fremy, Deville, Kopp, Scharling, and Carles, partly at least due to the fact that the mode of operating was calculated in some cases to bring about decomposition of the bodies originally present. The author dissolved 1 kilo. of partly resinized tolu balsam in 2 litres of ether, filtered the liquid from a little insoluble matter, and then agitated it with 2 litres of soda-solution containing 100 grams Na_2O; after agitating the ethereal liquor again with soda, and washing with water, a residue was obtained on distilling off the ether, consisting of 85 grams of fluid neutral compounds. On fractional distillation, a little passed over below 200°, more between 250° and 300°, and most of all above 320°. The first of these fractions appeared on analysis to be impure benzylic alcohol; it formed benzoic aldehyde and acid on oxidation. The second gave a distillate at 300°, consisting of *benzyl benzoate*, $C_{14}H_{12}O_2$; on saponification it formed benzylic alcohol and a benzoate. The third portion consisted of *benzyl cinnamate*, $C_{16}H_{14}O_2$; it furnished cinnamic acid and benzylic alcohol on saponification, and had the sp. gr. 1·1145 at 16°. Hence the natural constituents of tolu balsam are the same as those found by Kraut in Peru balsam, only they exist in smaller quantity and different proportions,—benzyl cinnamate forming the majority in the first, benzyl benzoate in the second.

The soda liquors obtained as above described were saturated with carbonic acid, whereby much resin was precipitated. The filtrate yielded a precipitate on addition of hydrochloric acid; one-half of the cinnamic acids thus thrown down was boiled with milk of lime. A sparingly soluble lime salt was thus obtained, containing (after recrystallization) 10·26 per cent. of calcium, the cinnamate requiring 10·30 per cent.; from this cinnamic acid, melting at 133°, was isolated. The mother-liquors of the sparingly soluble calcium cinnamate contained much calcium benzoate, which crystallized out after concentration; this gave (after several recrystallizations) numbers agreeing with the formula $Ca(C_7H_5O_2)_2 + 3H_2O$; and from it benzoic acid was precipitated, melting at 120·5°.

The other half of the mixture of acids was dissolved in alcohol and treated with hydrochloric acid gas. By fractional distillation the ethers thus formed were separated; the portion distilling at 215° gave numbers agreeing with the formula $C_9H_{10}O_3$, *ethyl benzoate;* that passing over at 265° agreed with $C_{11}H_{12}O_2$, *ethyl cinnamate.*

Hence tolu balsam contains free benzoic and cinnamic acids, as well as their benzylic ethers.

Determination of Phosphorus and Arsenic by Molybdate of Ammonia. P. Champion and H. Pellet. (*Bull. de la Soc. Chim.*, January 5, 1877; *Chem. News*, 35, 115.) M. Boussingault has shown that the approximation furnished by directly weighing the phospho-molybdate is superior to that obtained by redissolving the precipitate and determining the phosphorus as ammoniaco-magnesian phosphate. The error committed is the more appreciable the less phosphorus is present in the matter under analysis. According to M. Boussingault the phospho-molybdate contains 3·73 per cent. of phosphoric acid. The operation may be performed very rapidly by observing the following precautions:—Dissolve 100 grams molybdic acid in ammonia (about 150 c.c. of ordinary ammonia) and 80 of water. Pour it drop by drop into 500 c.c. of pure nitric acid and 300 c.c. of water. Stir, let settle, and filter if needful. Introduce into a capsule such a measure of the molybdic solution that the weight of the molybdic acid may be about fifty times the supposed weight of the phosphoric acid. Add ammonia to render the liquid alkaline; concentrate as far as possible the liquid containing the phosphoric acid, and mix the two solutions; raise the temperature to 70° to 80°, and pour in rapidly an excess of nitric acid until the yellow coloration appears, stirring briskly to aid the formation of the precipitate. Filter through a double tared filter, wash, and dry at 100° to 110°. The filtrate should be colourless. If it is yellow, the precipitation is incomplete; in this case ammonia is poured upon the filter to redissolve the precipitate, the solution is evaporated, and re-acidified with nitric acid. The same process may be successfully applied to the determination of arsenic, 100 grams of the precipitate of arsenio-molybdate of ammonia containing 5·1 of arsenic acid.

Compounds of Metallic Oxides with Glycerin. J. Puls. (*Journ. für pract. Chem.*, No. 2, 1877.) The author describes an extensive series of experiments on the solubility of various metallic oxides in glycerin, performed by adding aqueous solutions of metallic salts to mixtures of glycerin and HKO. Clear solutions were obtained when glycerin, ferric oxide, and caustic potash were in the molecular proportions of 3 : 2 : 1 and 3 : 3 : 2. After a short lapse of time the ferric oxide is precipitated spontaneously from the solutions, and has passed into the colloidal state. Cupric oxide does not show this peculiarity. With weak solutions of glycerin the water appears to exert a neutralizing influence upon the base present, which allows the solution of the oxide; but after a certain degree of concentration there is a fixed relation between the weights of glycerin and CuO dissolved. The author recommends the application of this fact for the analytical determination of glycerin. The hydrates of the alkaline earths are much more soluble in glycerin than the oxides of the heavy metals.

Titration of a Mixture of Alkaline and of Earthy Alkaline Sulphates. F. Jean and H. Pellet. (*Bull. de la Soc. Chim.; Chem. News*, 35, 152.) Let there be a mixture formed of sulphates of potassa, soda, lime, magnesia, and of alkaline and alkalino-earthy chlorides and nitrates. It is required to determine the sulphuric acid combined with alkalies and the sulphates of lime and magnesia. These determinations may be easily and exactly obtained by the use of two standard liquids,—the one of sulphuric acid, the other carbonate of soda, by operating in the following manner:—

1. *Titration of Sulphuric Acid combined with Alkaloids.*—The matter being dissolved in water (or in water acidulated with hydrochloric acid, if necessary) is exactly neutralized with soda in a diluted solution. To a volume of the liquid to be analysed we add a slight excess of baryta water, then seltzer water, and boil it to drive away completely the excess of carbonic acid, and to render insoluble all the carbonate of baryta. We filter, and pour into the clean liquid, coloured with a few drops of tincture of litmus, standard sulphuric acid to neutralization. The quantity of sulphuric acid employed to saturate the alkali is exactly the same as that which was originally combined with the alkalies, potash and soda.

2. *Titration of Sulphate of Lime.*—A volume of the saline solution

is mixed with alcohol; the sulphate of lime precipitated is collected on a filter, washed with alcoholic water, then introduced into a Bohemian glass, or into a capsule, with a known volume of a standard solution of carbonate of soda. We raise it to a boil, then separate by filtration the carbonate of lime arising from the decomposition of the sulphate. In the filtered liquid we titrate the carbonate of soda remaining; and we have by the difference the quantity of this salt passed into the state of sulphate of soda, which is calculated as sulphate of lime.

3. *Titration of Sulphate of Magnesia.*—The solution to be analysed is treated at a boil with a known volume of a standard solution of carbonate of soda. We separate by filtration the carbonate of lime and magnesia; and we determine in the filtered liquid, by the aid of standard sulphuric acid, the quantity of soda not decomposed, whence we calculate the amount of sulphuric acid belonging to the sulphate of lime and magnesia. The weight of the sulphate of lime being given by the preceding operation, we find by the difference that of sulphate of magnesia.

4. *Determination of total Sulphuric Acid.*—If in a mixture of salts we wish to titrate total sulphuric acid, free and combined, we boil the solutions with carbonate of soda, we separate the carbonate of magnesia and lime, and the liquid, filtered after having been exactly neutralised with standard sulphuric, is treated with baryta water, as in the titration of alkaline sulphates. This method of tritration gives very exact results when we employ a solution of sulphuric acid sufficiently dilute. Thus, in a mixture of salts containing total sulphuric acid 0·644 gram, we have found by our process 0·663 gram; and in 0·112 gram of sulphate of potash 0·110 gram.

Estimation of Theine in Tea. M. Markownikoff. (*Ber. der deutsch. Chem.-Ges.*, ix., 1312.) 15 grams of powdered tea leaves are boiled with 500 grams of water and 15 grams of calcined magnesia for some time; the decoction is filtered, the residue well washed, and the filtrate, together with the washings, evaporated, with the addition of a little calcined magnesia, to perfect dryness. Upon exhausting the dry residue with hot benzol, filtering, and evaporating the filtered solution, the theine is obtained in a pure state.

Coffee may be submitted to the same process.

Action of Hydrochloric Acid on Potassium Chlorate. G. Schackerl. (*Liebig's Annalen*, clxxxii., 193; *Journ. Chem. Soc.*, 1877, 47.) Pebal showed that the action of hydrochloric acid on potassium chlorate results in the formation of chlorine and hypochloric acid

($Cl O_2$) in varying proportions. The author's experiments on this subject have led to the conclusion that the action is represented primarily by the equation:—

$$K Cl O_3 + 2 H Cl = Cl O_2 + Cl + K Cl + H_2 O;$$

or, when sulphuric acid and potassium chloride are employed, by the equation,—

$$K Cl O_3 + K Cl + 2 H_2 S O_4 = Cl O_2 + Cl + 2 K H S O_4 + H_2 O;$$

but that, in most cases, there occurs a secondary action of free hydrochloric acid first formed, whereby the proportion of chlorine is increased. The extent to which this secondary action takes place was found to depend upon the amount and strength of the hydrochloric acid present in the liquid from which the gases were evolved. Thus, when a solution of potassium chlorate was run into hot hydrochloric acid of sp. gr. 1·19, the proportion by volume of the hypochlorous acid and chlorine evolved was 2/35·6; but when finely triturated potassium chlorate was decomposed with hydrochloric acid diluted with twice its bulk of water, the two gases were in the proportion of 2/1·71. Again, when a mixture of 1 molecule of potassium chlorate and 5 molecules of potassium chloride was decomposed by sulphuric acid, the hypochlorous acid and chlorine were evolved in the proportion of 2/5·54; but when a mixture of 4 molecules of chlorate and 1 molecule of chloride was decomposed in the same manner, the two gases were in the proportion of 2/1·27. Numerous other experiments were made, all leading to the same conclusion. In no case was pure chlorine obtained. The gases were analysed by Pebal's method.

Purification of Oleic Acid. L. Wolff. (*New Remedies*, from *Amer. Journ. Pharm.*) The author proposes the following method of obtaining oleic acid of sufficient purity to prepare the oleates at present in use:—Oil of sweet almonds is saponified with caustic potassa; the soap is decomposed with tartaric acid, and washed with hot water to separate the precipitated potassium bitartrate from the mixture of oleic and palmitic acids. These are combined with litharge, forming oleo-palmitate of lead, from which petroleum benzin dissolves the oleate of lead, leaving the other salt as a residue. From the benzin solution the lead is precipitated by dilute hydrochloric acid, in form of lead chloride; and on evaporation of the benzin, oleic acid will remain, sufficiently pure for pharmaceutical purposes, giving clear and permanent solutions with the red and yellow varieties of mercuric oxide, as high as 30 per cent. if necessary. As crude commercial oleic acid can be bought at very low figures, this may be made the starting-point of the process, yielding a purified acid at a very small expense. To gain the same end, the simplest way is perhaps to use the ready-made oleo-palmitate of lead,—the officinal lead-plaster,—to dissolve it in benzin, and extract from it the oleic acid by precipitating the lead by hydrochloric acid. Oleic acid thus prepared has been used for some time, and found to answer better for the preparation of the oleates, than the article sold by some of the manufacturing chemists.

Determination of Albumen in Urine. J. Stolnikow. (*Chem. Centralbl.*) The urine is diluted with water, until a sample poured upon some nitric acid contained in a test-tube produces still a faint white ring at the point of contact after the lapse of forty seconds. The number of volumes of water, added to the volume of the urine (which may be taken as 1), is divided by 250, and the quotient will be the percentage of albumen in the urine. This relation has been established and confirmed by gravimetric determinations.

Soap Analysis. (From *Chem. News*, xxxv., 2.) *Weighing.*—In all methods usually given in text books the analyst is directed to weigh out for each operation small portions (1 to 5 grams) of the sample. This plan is to be avoided, and for two reasons:—(1) Soap is extremely variable in composition, and considerable variations are possible even in the same sample; (2) it is perpetually losing water by evaporation from its surface. As the soap is usually weighed in the form of thin shavings, the surface exposed is, in relation to the weight taken, very considerable. These two sources of inaccuracy are obviated by weighing out for the analysis a section cut through the bar at right angles to its length (60 to 80 grams), dissolving in distilled water, and making the volume up to 1000 c.c. (in the cold); 50 c.c. of this solution are measured off for this operation. It should be observed, that as some of the alkaline salts of the fatty acids separate out from the solution on cooling, it must be well mixed by agitation previously to drawing off each 50 c.c. The several operations are conducted as follows:—

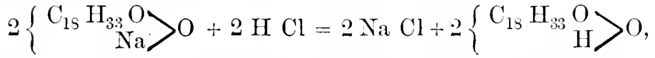
1. *Total Alkali.*—50 c.c. of the solution are diluted to about 200 c.c., the liquid is coloured faintly with eosine, and standard acid is run in. taking care to stir briskly with a glass rod. The neutral point is extremely well marked by the sudden decolorization of the whole. The cause of this apparent destruction of colour is the union of the fatty acids with the eosine at the moment of their complete separation from the fluid.

2. *Uncombined Alkali.*—50 c.c. are added to 300 c.c. of a saturated solution of common salt. which must be of course neutral to test

paper, and the volume made up to 400 c.c. The neutral alkaline salts of the fatty acids (*i.e.*, true soap) are precipitated; any excess of alkali present remains in solution,—this is determined in an aliquot part of the filtered solution. The filter must not be moistened previous to filtration. From this the total uncombined alkali is calculated, and subtracted from the *total alkali* already found. Then the *combined* and *uncombined* alkali are determined.

3. *Fatty Acids.*—50 c.c. of this solution are introduced into a stoppered separating funnel, decomposed with excess of acid, and agitated with carbon disulphide until the liberated fatty acids are dissolved. The disulphide solution of the fats is drawn off into a tared flask; the aqueous solution is washed once or twice with small portions of disulphide, the whole of which is then separated from the fats by distillation. The fats are purified from the last traces of $C\,S_2$ by heating the flask for a short time at 100° C.; the weight, after cooling, less the tare, gives the weight of the fatty acids. Ordinary ether may be used in place of the $C\,S_2$; it has, however, the disadvantage of retaining small quantities of water, and therefore aqueous acids, which must be driven off at the end of the operation by exposing to a temperature of 100° to 120° C., until the weight is constant. Further, the ethereal solution will be the upper stratum, and is, for obvious reasons, not so easily to be manipulated as the bisulphide solution, which forms the lower layer.

Note.—A moment's consideration of the following equation, representing the composition of sodic oleate by H Cl—



$$2\left\{\begin{matrix}C_{18}\,H_{33}\,O\\ \quad Na\end{matrix}\right\rangle O + 2\,H\,Cl = 2\,Na\,Cl + 2\left\{\begin{matrix}C_{18}\,H_{33}\,O\\ \quad H\end{matrix}\right\rangle O,$$

will make it evident that while the fatty acid is present in the soap in the form of anhydride, it is separated and weighed in the course of analysis as hydrate. A correction must, therefore, be applied, based upon the fact that 282 parts oleic hydrate equal 273 parts oleic anhydride; *i.e.*, the weight of the fatty acids is to be multiplied by the decimal fraction 0·97.

In the case of the "olein" soap of commerce, a very rapid and tolerably accurate estimation may be made in the following way:—50 c.c. of the solution are decomposed with H Cl in a small flask, the neck of which is long and narrow, and graduated in c.c., and so much water added that, upon heating in the water bath the separated oil will rise into the neck and fall entirely within the graduated portion. The heating must be continued, with occasional tapping of the flask, until the whole of the fat has been separated and has risen into the neck.

The flask is allowed to cool, and when cool the volume of the oil is read off. This quantity, multiplied by the specific gravity of the oil, gives its weight. The specific gravity (which the writer almost always found to be 0·9) may be determined by pouring off a small quantity into a capsule (a second reading will give the volume taken), and weighing it; the weight divided by the volume is the required specific gravity.

4. *Water.*—If the purity of the sample has been ascertained, this constituent may be calculated by difference. The direct estimation is effected by evaporating 50 c.c. of the solution to dryness on the water bath (finally on the air bath from 100° to 120° C.) in a weighed dish. The residue is anhydrous soap; from its weight the percentage of water on the soap may readily be calculated. It may be observed that the usual method, which consists in the exposure of the soap, previously cut into thin shavings and weighed, to the temperature of boiling water until it ceases to lose weight, is inaccurate, as it fails to drive off the last portions of water (1 to 2 per cent.), which seem to have contracted a stronger union with the soap.

5. *Mineral Impurities and Unsaponified Fat* may be detected by taking the dried soap from the preceding operation, dissolving in strong alcohol, and filtering through a funnel heated by means of a jacket of hot water. Mineral impurities remain upon the filter as an insoluble residue, the weight of which is readily ascertainable. The alcoholic filtrate is evaporated with successive additions of distilled water; by these means any unsaponified fat or resin is separated from the soap, which of course remains in aqueous solution. This solution may be used for No. 1, 2, or 3. The mineral impurities may be examined qualitatively after drying and weighing.

Preparation of Potassium Bicarbonate. L. Pesci. (*Journ. Chem. Soc.*, Oct., 1876, 381.) The author finds that the best method of preparing pure potassium bicarbonate, free from chloride and nitrate, is to pass a current of carbonic anhydride to saturation though a solution of potassium hydrate in alcohol of 80 per cent. At first neutral carbonate is formed, which withdraws the water from the alcohol, forming a dense stratum at the bottom of the vessel; but on continuing the passage of the gas this becomes pasty from deposition of crystals of the bicarbonate. The alcohol containing chlorides and nitrates is now decanted and replaced by a fresh quantity, the passage of the gas being continued, with occasional agitation, until the pasty precipitate becomes pulverulent and the liquid is saturated with carbonic anhydride. The bicarbonate, after being thoroughly washed with alcohol, is found to be pure.

A New Test for Alcohol. E. W. Davy. (*Proc. Royal Irish Academy*, ii., 579.) The reagent recommended is a solution of 1 part of molybdic acid in 10 parts of pure concentrated sulphuric acid. On warming this solution gently in a porcelain dish, and then adding a few drops of a liquid containing alcohol, a blue coloration is developed, which gradually disappears on exposure to the air, but is reproduced on expelling the absorbed moisture by evaporation. The alcohol may thus be detected in a single drop of a mixture containing 1 part of alcohol to 1000 parts of water. The test is specially recommended for the detection of alcohol in chloroform and chloral hydrate.

Shellac and Sarcosinic Acid. J. Hertz. (*Archiv der Pharmacie* [3], viii., 234; *Journal Chem. Soc.*, April, 1877.) This variety of shellac was obtained from Mexico, where it is known as "somo de sonora," and called by the Indians "arré." It exudes from the *Mimosa coccifera*, the native name for which is "tzinacaia cuitlaquahuitl." It has an astringent, bitter taste, and a yellowish or brownish colour. It is used as a remedy for diarrhœa and uterine discharges.

East Indian shellacs are treated with water before they are delivered to the European market, to extract an acid substance and a red dye, which forms 10 per cent. of the weight of the crude gum.

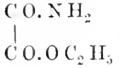
The American specimen lost 6 per cent. of its weight on treatment with hot water. It was then treated with alcohol, which dissolved about half; the solution, on evaporation, left a transparent brittle residue, which had all the appearance of good shellac. The portion which refused to dissolve in alcohol was soluble in boiling potash, with a fine red colour; on addition of acid the solution became colourless, and a yellowish white resin separated, which was partially soluble in alcohol. These reactions correspond with those of shellac.

The aqueous solution contained two substances,—a colouring matter and an acid body. The colouring matter was removed by lead acetate, and the filtrate evaporated after removal of the lead. The colouring matter was soluble in water with a fine red colour, and insoluble in alcohol and in ether. It could not be obtained in a crystalline state. Its solution showed a strongly acid reaction. The filtrate from the colouring matter deposited crystals, easily soluble in water and insoluble in alcohol and in ether. They were purified by solution in boiling aqueous alcohol, from which they deposited as a powder on cooling. The formula of the acid was found to be $C_3 H_7 N O_2$, and it was named "sarcosinic acid."

The *barium salt* is an amorphous powder, soluble in water but not in alcohol. The *silver salt*, $C_3H_6NO_2Aq$, forms yellowish white nodules, and is reduced on exposure to light. The *sodium salt* crystallizes with 6 molecules of water, and forms colourless hexagonal tables. The *calcium salt* crystallizes with one molecule of water, and is an amorphous powder.

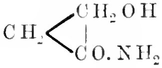
The acid does not evolve ammonia when boiled with caustic soda, but on heating with soda-lime it does. It melts at 195°, and chars at a higher temperature without subliming. The acid is isomeric with alanine, sarcosine, lactamide, and urethane. The two latter, however, are indifferent bodies: lactamide, when heated with soda, decomposes into lactic acid and ammonia; urethane into carbonic anhydride, ammonia, and ethyl alcohol. Sarcosine unites only with acid, and it is doubtful whether it is an amido-acid; it evolves methylamine on ignition with soda-lime. Alanine, when treated with nitrous anhydride, yields lactic acid. These bodies are assumed, therefore, to have the following constitution:—

Urethane.



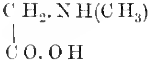
$$\begin{matrix} CO.NH_2 \\ | \\ CO.OC_2H_5 \end{matrix}$$

Lactamide.



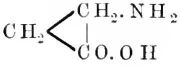
$$CH_2\left\langle \begin{matrix} CH_2OH \\ | \\ CO.NH_2 \end{matrix}\right.$$

Sarcosine.



$$\begin{matrix} CH_2.NH(CH_3) \\ | \\ CO.OH \end{matrix}$$

Alanine.



$$CH_2\left\langle \begin{matrix} CH_2.NH_2 \\ | \\ CO.OH \end{matrix}\right.$$

Sarcosinic acid appears to be more nearly related to sarcosine and alanine than to lactamide or urethane; yet sarcosine is a base, while sarcosinic acid is a true acid. The acid, however, was found to form a hydrochlorate and nitrate. With nitrous anhydride nitrogen was evolved and lactic acid was formed. The acid, therefore, has great analogy to lactic acid, from which it differs only in taste, crystalline form, and marked acid properties. The author attributes to it the same constitutional formula as to alanine; but intends to attempt to prepare it synthetically, to decide wherein the difference lies. E. Reichart attributes to it the formula, $CH_2.NH_2.CH_2.COOH$.

Note on Litmus. H. W. Mitchell. (*American Chemist*; from a paper read before the American Chemical Society, June, 1876.) Wartha has separated four organic bodies from litmus. The first is obtained by treating commercial litmus with alcohol of about 90 per cent., filtering cold, and boiling the clear tincture; whereupon indigo is precipitated as a fine power, according to the author. The second body is obtained by evaporating the violet red mother-liquor; it is a beautiful red, or, from many varieties, green fluorescent substance, indifferent to acids. The litmus residue left after treatment with alcohol is digested with distilled water for twenty-four hours; after which the deep coloured solution is evaporated on the water bath, and the residuary extract is treated several times with absolute alcohol containing a little glacial acetic acid, and again evaporated, until it forms a brown powdery mass. This mass is now exhausted with absolute alcohol and acetic acid, whereby a large quantity of a scarlet red body is dissolved, which resembles orcin, and becomes purple red in place of blue with ammonia. The portion of the brown powder insoluble in the acidified alcoholic solution consists of litmus colouring matter in a very pure form; so pure, in fact, that by means of it the carbonated alkaline earths contained in spring waters may be titrated with as great delicacy as by the use of cochineal mixture; which is far from being the case with crude litmus. To get this substance perfectly pure, it is first washed with absolute alcohol, then dissolved in a small quantity of water and thrown into a large excess of alcohol and the flocculent purple precipitate is collected and again thoroughly washed with alcohol. In repeating the above experiments, the author confirms Wartha's results in every particular save as regards the indigo, which could not be obtained by boiling the alcoholic tincture. The fluorescent body above mentioned is violet or purple, and gives a solution in alcohol of a similar colour, which shows a beautiful green fluorescence with sunlight, and with the spectroscope gives a very characteristic absorption-band in the green, together with an almost total absorption of the violet end of the spectrum. It is soluble in water, amylic alcohol, and common ether; very soluble in alcohol; but is insoluble in carbon bisulphide, chloroform, petroleum naphtha, and turpentine. The solutions, both in amylic alcohol and in ether, exhibit a beautiful fluorescence; but the ethereal solution shows the absorption-band in the green only very faintly. The body which resembles orcin shows a very faint fluorescence; its alcoholic solution gives a spectrum in which the absorption is characteristic and quite distinct from that of the last. It is slightly soluble in water, very soluble in alcohol, but seems to be insoluble in ether, chloroform, carbon disulphide, and petroleum naphtha. The pure litmus colouring matter is insoluble in alcohol, ether, chloroform, bisulphide, of carbon, and petroleum naphtha; very soluble in water. It turns blue with ammonia, and yields with alkaline solutions a beautiful violet lake with alumina, one of a pale violet colour with stannous acetate, and deep blue lakes with calcium and barium.

The residue left after extracting the pure litmus dissolves to some extent in hydrochloric acid. The residue insoluble in hydrochloric acid consists mostly of fine sand, but yields some colouring matter to strong ammonic hydrate. About 25 grams of the pure colouring matter (15 grams of the body like orcin, and 10 grams of the fluorescent body) were obtained per ounce of litmus.

Emodin from Rhamnus Frangulæ Bark. C. Liebermann and M. Waldstein. (*Ber. der deutsch. Chem.-Ges.*, 1876, 1775–1778.) Old frangula bark was exhausted with dilute soda solution, and the liquid precipitated by hydrochloric acid; the precipitate was again boiled with soda, and precipitated by H Cl; then washed, dried, and repeatedly crystallized from boiling absolute alcohol. A small quantity of a glucoside was removed by boiling with dilute sulphuric acid and crystallizing from alcohol or glacial acetic acid. The authors obtained it from the latter liquid in the form of orange coloured silky needles, containing acetic acid and water, which are expelled at 140° C., the crystals becoming opaque.

Ultimate analysis proving the composition of the crystals to be $C_{15} H_{10} O_5$, their identity with emodin from rhubarb was further proved by the solubilities, form of crystals, and colour of alkaline solution; also by the following behaviour:—baryta and lime water yielded red precipitates, which were soluble in boiling water with a red colour; alum solution dissolved slightly with a yellow colour, ammonia yielding red precipitates; evaporation with nitric acid yielded yellow nitro compounds, soluble in water with a red colour. The behaviour towards glacial acetic acid was that stated above.

The frangulinic acid of Faust differs in some respects from emodin; it is not impossible that it may be contained in the recent bark, and gradually converted into emodin by oxidation.

Preparation of Pure Bismuth and Bismuth Compounds. H. Thürach. (*Journ. prakt. Chem.* [2], xiv., 309–316; *Journ. Chem. Soc.*, March, 1877, 283.) The usual impurities, even in what is sold as pure bismuth, are silver and iron. Quesneville's process, viz., fusing the metal with nitre, has the disadvantage of being extremely wasteful, a large quantity of bismuth being oxidised. Nor can bismuth be separated from it by precipitation as oxychloride with water, for iron is invariably a constituent of the precipitate. If the bismuth be fused under a mixture of potassium chlorate and a little sodium carbonate, the iron is completely oxidised, while very little bismuth is lost; for the fused mass does not become alkaline, as is the case when nitre is used as a flux. Two to five per cent. of sodium carbonate should be added, and the fusion should last for a quarter of an hour. No method of separating bismuth from iron by the wet method was successful, except by crystallizing the double chloride of bismuth and the alkalies, and by precipitating the bismuth from a slightly acid solution with oxalic acid. The bismuth oxalate, $Bi_2(C_2O_4)_3 + 15H_2O$, comes down absolutely free from iron. Too large an excess of oxalic acid should be avoided, for the oxalate is slightly soluble in the acid; the precipitate should not be allowed to stand too long in contact with water, else the basic oxide is formed which retains the iron. The oxalate on ignition yields metallic bismuth.

This process has not been attempted quantitatively.

The only method of separating silver from bismuth is to oxidise the bismuth, and leave metallic silver.

Bismuth is best precipitated as sulphide. The liquid is then warmed, when the sulphide cakes together and may be easily filtered and washed. On ignition in air it is converted into bismuth oxide, and may be weighed as such.

Santonin and Santonic Acid. MM. Cannizzaro and Sestini. (*L'Union Pharmaceutique*, xvii., 136.) Santonic acid is obtained from santonin by boiling the latter for twelve hours with a saturated solution of barium hydrate, decomposing the barium santonate thus formed with hydrochloric acid, and taking up the liberated santonic acid by ether. The authors have previously shown (1873) that this substance is isomeric with santoninic acid, but not resolvable like the latter into santonin and water.

Pure santonic acid forms orthorhombic prisms which, unlike satonin, are not affected by light and do not produce a violet coloration with potassium hydrate. Its composition is represented by the formula $C_{15}H_{20}O_4$; it fuses at 161°-163° C., and is readily soluble in boiling water, alcohol, ether, and chloroform. Its sodium and barium salts—$NaC_{15}H_{19}O_4$, and $Ba2C_{15}H_{19}O_4$—are extremely soluble in water and difficult to crystallize. Though the authors have hitherto been unable to convert santonic acid into santonin, they have produced from it metasantonin, a substance isomeric with santonin, by boiling it with hydriodic acid and phosphorus. This new derivative forms white crystals, which fail to yield a santonate on boiling with solution of barium hydrate, and which can be distilled in a vacuum without suffering decomposition.

By the action of bromine on an acetic acid solution of santonin, the authors obtained a body crystallizing in red needles and corresponding to the formula $C_{15}H_{18}O_3Br_2$.

Testing of Salicylic Acid. H. Kolbe. (*Journ. prakt. Chem.* [2], xiv., 143). Half a gram of the acid to be tested is dissolved in about five grams of strong alcohol, and the clear liquid allowed to evaporate slowly in a watch glass at the ordinary temperature.

The acid will form groups of fine efflorescent crystals round the edge of the glass. These crystals should be of a pure white colour, if the acid was previously crystalline; but more or less yellow if precipitated. If the crystals are at all brown, the acid is impure.

Simplified Method of Extracting Poisonous Alkaloids in Forensic Investigations. F. Selmi. (*Journ. Chem. Soc.*, from *Gaz. Chim. Ital.*, vi., 153.) The alcoholic extract of the viscera, acidified and filtered, is evaporated at 65°, the residue taken up with water, filtered to separate fatty matters, and decolorised by means of basic acetate of lead, leaving the solution in contact with the air for 24 hours. It is then filtered, the lead precipitated with sulphuretted hydrogen, and the solution, after concentration, repeatedly extracted with ether. The ethereal solution is then saturated with dry carbonic anhydride, which generally causes a precipitate of minute drops, adhering to the sides of the vessel, and containing some of the alkaloids. The ethereal solution is then poured into a clean vessel, mixed with about half its volume of water, and a current of carbonic anhydride passed for 20 minutes, which may cause the precipitation of other alkaloids not precipitated by dry carbonic anhydride. Usually the whole of the alkaloids present in the ether are thrown down by these means; but if not, the solution is dehydrated by agitation with barium oxide, and then a solution of tartaric acid in ether added to the clear liquid, taking great care not to employ excess of acid. This throws down any alkaloid that may remain. In order to extract any alkaloids that may still remain in the viscera, they are mixed with barium hydrate and a little water, and then agitated with purified amylic alcohol; the alkaloids may subsequently be extracted from the alcohol by agitation with very dilute sulphuric acid.

Notes on Atropine. F. Selmi. (*Gazzetta Chimica Italiana*, vi., 155.) In connection with the foregoing article on the extraction of poisonous alkaloids, the author refers specially to atropine and some of its decomposition products. As atropine is readily decomposed into tropine and atropic acid, and might become altered in the process of extraction from the viscera, etc., he studied the action of various reagents on the alkaloid. Boiled with a solution of barium hydrate in contact with the air, it gave a pleasant odour of hawthorn flowers, but no odour was observed on distilling the mixture. The residue contained tropine, which was extracted with ether. Atropine was decomposed when boiled with dilute sulphuric acid, or with a solution of tartaric acid, but no odour was developed; a substance (A) being obtained from the solution on treatment with ether, very different in its reactions from tropine. The action of ammonia on atropine yields two substances of the nature of an alkaloid; one (B) precipitable by carbonic anhydride from the ethereal solution; the other (C) not precipitable. Their reactions are as follows:—

	Tropine.	A.	B.	C.
Tannic Acid	White	White	White	—
Iodized Hydriodic Acid . .	Brown drops	—	Brown	Brown
Platinum Perchloride . .	Turbidity	None	None	None
Picric Acid	—	Id.	Id.	Id.
Meyer's Reagent . . .	White	Id.	Id.	Id.
Gold Chloride	Yellow	Yellow	Yellow	Yellow
Brominated Hydrobromic Acid	None	—	Yellowish	Id.
Mercuric Chloride . . .	Straw yellow	White	White	White
Sodium Phosphotungstate .	—	—	Id.	Id.
Iodide of Potassium and Bismuth	—	Orange yell.	Yellow	Yellow
Iodide of Potassium and Cadmium	White	—	White	White

From experiments made on the putrefied viscera of an animal poisoned with atropine, and on the alkaloids generated by the putrefactive process in the viscera themselves, the author finds that one of those formed in the latter case, and which may be extracted by the use of amylic alcohol (although not by ether), closely resembles atropine in its action on the animal organism. Atropine may be distinctly recognised, however, by the characteristic odour of hawthorn given off during evaporation with baryta and by the bitter taste and poisonous action of the ethereal extract, accompanied by dilation of the pupil.

Estimation of Urea. M. Depaire. (*Journ. de Pharm. d'Anvers*, February, 1877.) The author desired to arrive at a process which would give reliable results, even in the hands of those persons who are not specially trained in chemical manipulations. He adopts the process of Yvon and Esbach, with certain modifications. Sodium hypobromite is used with excess of an alkali, to decompose the urea, and the resulting nitrogen gas is measured over water, which retains the other products of the decomposition, namely, carbonic anhydride and water. 10 centigrams of urea, decomposed by sodium hypobromite in alkaline solution, gives off a volume of nitrogen which measures 37 c.c. at 0° C., and 760 mm. pressure. In order to avoid calculations, the plan of Yvon may be adopted, namely to make a preliminary trial upon a known solution of urea just before examining the urine, and to compare the two results.

Naturally the amount of urea corresponding to the urine must be increased in the same ratio as the figure found for 0·10 gram of pure urea exceeds 37. Supposing 10 centigrams of pure urea have been treated in the manner described, and have disengaged 40 c.c. of nitrogen and 10 c.c. of an unknown solution of urea, or of urine, disengage under the same circumstances 66 c.c. The quantity of urea contained in the latter will be found as follows:—$40 : 10 = 66 : x : x = 16{\cdot}5$ centigrams. The result will be correct as long as there is not present an excess of uric acid or albumen. In the former case, it is best to expose the urine to cold, to promote the crystallization of the uric acid and urates, which are then removed; and in the latter case, the urine must be heated in a closed vessel, so as to coagulate the albumen.

Titration of Oxalic Acid and Oxalates. F. Jean and H. Pellet. (*Bull. de la Soc. Chim.; Chem. News*, 35, 248.) The determination of free oxalic acid, or of oxalates, may be effected very exactly by the aid of baryta water and a standard solution of sulphuric acid. For this purpose the solution to be assayed is carefully neutralized with a dilute solution of soda, then mixed with baryta water in a slight excess and filtered. The filtrate is then mixed with seltzer water, raised to the boiling point, separated by filtration from the carbonate of baryta, and in the clear liquid the alkali is titrated with standard sulphuric acid. 0·0777 gram of $SO_3HO = 0{\cdot}1$ gram $C_2O_3 3HO$. 10 c.c. of a solution containing 1 per cent. of $C_2O_3 3HO$, required 11·8 c.c. of a standard acid, of which 10 c.c. = 0·066 gram of SO_3HO; that is, 0·0778 of sulphuric acid. 0·10001 gram of oxalic acid was thus found, instead of 0·1 gram. In another assay the number obtained was 0·0999 gram.

In order that this process of titration may give good results, care must be taken to separate the oxalate of baryta before adding seltzer water; for this salt is very sensibly decomposed by carbonic acid, and the neglect of this precaution would lead to grave errors. The authors also applied this process to the titration of borates and tartrates; but the assays made with this view never gave good results. With boric acid it is impossible to seize the point of neutralization; and the borates of baryta are all more or less soluble in an alkaline liquid. The tartrate of baryta is equally soluble in baryta water and in alkalies, in the latter case forming double tartrates.

Titration of Chlorides in the Presence of Phosphates. H. Pellet. (*Bull. Soc. Chim.* [2], xxii., 246.) The solution to be tested is acidified with nitric acid, and then neutralized with calcium carbonate. The chlorine may now be titrated with silver nitrate in the usual way, potassium chromate being used as an indicator. A correction should be made for the excess of silver nitrate by mixing a quantity of distilled water, equal in volume to that of the liquid in which the chlorine was determined, with a few drops of solution of potassium chromate, and adding the standard silver solution till the red coloration is produced. The presence of sugar, or similar organic substances, does not interfere with the process.

Indirect Estimation of Ammonia in Ammonium Salts. H. Pellet. (*Bull. Soc. Chim.* [2], xxii., 250.) A solution of 10 grams of the ammonium salt in 30 or 40 c.c. of water is mixed with a few decigrams of pure calcium carbonate, to insure perfect neutrality. It is then made up to 500 c.c., and filtered. The filtrate is now boiled with an excess of titrated solution of sodium hydrate until the ammonia is completely expelled, when the excess of soda is determined with titrated sulphuric acid.

Chemical Constitution of Chlorinated Lime. C. Stahlschmidt. (*Dingl. polyt. Journ.*, ccxxi., 335–345; *Journ. Chem. Soc.*, March, 1877.) Gay-Lussac represented chloride of lime by the formula $CaOCl_2$, according to which pure chloride of lime should contain no calcium chloride. Göpner sought to establish this view by the assumption that chloride of lime, on treatment with dilute mineral acids, yields pure chlorine, and no hypochlorous acid. This assumption has been proved untenable by Schorlemmer, who obtained hypochlorous acid by distilling with dilute nitric acid. Richter and Junker also contended that no calcium chloride is contained in chloride of lime; and this they sought to prove by boiling a solution of 1 gram of chloride of lime in 20 c.c. of a 20 per cent. phosphoric acid solution, till all smell of chlorine had disappeared, and then find no calcium chloride left. Thus they assumed that such a phosphoric acid solution cannot decompose calcium chloride on being boiled with it, and that only the chlorine of the compound $CaO.Cl_2$ is liberated. The author has, however, found that phosphoric acid solutions will decompose calcium chloride with liberation of hydrochloric acid. Kolb found that the richest chloride of lime he could prepare contained 38·72 per cent. actual chlorine; and this coincides with a formula, $3(CaO.H_2O) + 4Cl$, or $2(CaO.H_2O.Cl_2) + CaO.H_2O$. This chloride of lime should be decomposed by water, as follows:— $3(CaO.H_2O) + 4Cl = CaOH_2O$ as a precipitate, and $2CaOCl_2$ going into solution. Then the true constitution of the chloride of lime dissolved in water, as given by Ballard, should be: $2CaOCl_2 = CaOCl_2O + CaCl_2$.

In a more recent publication, Kolb gives to chloride of lime this formula, $2\,(\mathrm{Ca\,O\,Cl_2}) + \mathrm{Ca\,O} + 3\,\mathrm{H_2\,O}$; the filtered solution consisted as before of $\mathrm{Ca\,O.\,Cl_2\,O}$ and $\mathrm{Ca\,Cl_2}$. In the first formula, Kolb assumes that water belongs to the constitution of chloride of lime; but afterwards he appears to forsake this view. According to Kolb also, three molecules of calcium hydrate are acted on by four atoms of chlorine to form chloride of lime; and thus far he and the author are agreed.

The author used in his experiments only chloride of lime which contained 39 per cent. of actual chlorine, and which had been formed exactly according to the formula $3\,\mathrm{Ca\,H_2\,O_2} + 4\,\mathrm{Cl}$. In a beaker a quantity of the above chloride of lime was treated with water, a trace of cobalt sulphate added, and the whole boiled. In this manner the calcium hypochlorite formed is converted, with liberation of oxygen, into calcium chlorate and calcium chloride, without a trace of chlorine escaping. The boiling was continued till a drop of the solution produced no coloration on iodized starch paper. Carbonic acid was then passed into the solution for several hours, whereby the calcium hydrate separated at first was converted into calcium carbonate. Finally, the whole was boiled for some time to drive off free carbonic acid, and separate any carbonate that might have been dissolved thereby. The precipitate was collected on a filter, washed and weighed, and the amount of caustic lime therein calculated. This amount agreed well with the equation,—

$$2\,\mathrm{Ca\,H\,Cl\,O_2} + \mathrm{Ca\,Cl_2} + 2\,\mathrm{H_2O} = \mathrm{Ca\,Cl_2\,O_2} + \mathrm{Ca\,H_2\,O_2} + \mathrm{Ca\,Cl_2} + 2\,\mathrm{H_2\,O}.$$

The chloride of lime was next treated with freshly prepared sulphurous acid—quite free from sulphuric acid—until the reaction with iodized paper ceased. Thus two molecules of sulphurous acid were converted into sulphuric acid by one molecule of hypochlorous acid, and this united with an equivalent quantity of lime, setting free a corresponding proportion of hydrochloric acid. The whole was then evaporated on the water bath to dryness, when the free hydrochloric acid escaped, and sulphate of lime remained, together with one molecule of calcium chloride originally existing in the dry chloride of lime:—

$$\mathrm{Ca\,Cl_2\,O_2} + \mathrm{Ca\,H_2\,O_2} + \mathrm{Ca\,Cl_2} + 2\,\mathrm{S\,O_2} = 2\,\mathrm{Ca\,S\,O_4} + 2\,\mathrm{H\,Cl} + \mathrm{Ca\,Cl}\,.$$

The calcium chloride was then estimated with silver solution. The results agreed well with the formula quoted.

The behaviour of chloride of lime at high temperatures was next tested. It is already known that chloride of lime, under the influence of heat, decomposes with formation of calcium chloride and chlorate, and liberation of oxygen gas and sometimes of chlorine.

With a less intense heat, according to Morin, one-third of the calcium hypochlorite passes into chloride and chlorate, whilst two-thirds remain unaltered; and then a stronger heat decomposes this into calcium chloride and oxygen.

When freshly prepared chloride of lime is heated in a bulb tube between 100° and 120°, water and chlorine escape. When the temperature rises, no more chlorine escapes after a certain point; but at and above 300°, pure oxygen is liberated. When an incipient red heat is attained, the whole melts to a fluid mass, clear and transparent as water, resembling fused nitre; and on cooling solidifies to a crystalline mass, resembling the latter salt in appearance under like conditions. At a red heat a further liberation of gas takes place, and the mass then becomes muddy, opaque, and thick, with separation of an insoluble compound. By heating chloride of lime, all the chlorine which escapes does so as chlorine, not a trace as hydrochloric acid.

For the estimation of the water in chloride of lime, a portion of the body was heated in a bulb tube, first slowly, and then afterwards to ignition; a current of dry air, free from carbon dioxide, being passed over it, and the water escaping being retained by a calcium chloride tube.

The amount of water thus estimated agreed very well with the formula, $2\,Ca\,Cl\,H\,O_2 + Ca\,Cl_2 + 2\,H_2\,O$. It appears then that this final molecule of water is not liberated even at a red heat.

Another portion of the chloride of lime was now mixed with dry, ignited sodium carbonate, and the whole ignited in the bulb tube, so that the mass does not quite fuse. Three molecules of water were thus set free, with simultaneous formation of calcium carbonate, sodium chloride, and free oxygen. The numbers obtained completely bear out the formula $2\,Ca\,H\,Cl\,O_2 + Ca\,Cl_2 + 2\,H_2\,O$.

By the first heating 9·96 per cent. of water escaped, and by the second 5·04 per cent.; total, 15 per cent.

It was finally discovered that by heating chloride of lime to 120°, 4·6 per cent. of chlorine were given off, and by further heating over the lamp 10·85 and 11·60 per cent. Under these circumstances also, 9·89 per cent. of water and some oxygen were liberated. At first then there are liberated from one molecule of chloride of lime, besides the $2\,H_2\,O$, also $1\,Cl + 1\,O$; and further, by stronger heating, $\frac{1}{2}\,O$ follows.

The loss for the	$2\,H_2\,O$ =	9·89 per cent.	24·03 per cent.
,, ,,	$1\,Cl$ =	9·75 ,,	
,, ,,	$1\,O$ =	4·39 ,,	
,, ,,	$\frac{1}{2}\,O$ =	2·19 ,,	
Total loss	=	26·22 ,,	

A portion of the chloride was now ignited, the residue dissolved in water, and the amounts of calcium hydrate and calcium chloride determined.

The results agreed sufficiently well with the formula mentioned, 100 parts of chloride of lime contain, according to the formula, 19·23 per cent. of lime ($Ca\,O$), and 53·36 per cent. of calcium chloride. *Results obtained:*—Lime, 18·83 and 18·11 per cent.; calcium chloride, 51·00 and 52·24 per cent.

It is now shown that if the actual compound in chloride of lime were $Ca\,O\,Cl_2$, as according to Göpner, then by necessity it must have been formed as follows:—$3\,Ca\,H_2\,O_2 + 4\,Cl = 2\,Ca\,O\,Cl_2 + Ca\,H_2\,O_2 + 2\,H_2\,O$. But this formula fails to explain several of the results obtained by the author, and chiefly that by which it appears that the third molecule of water is obstinately retained in the compound; for had it been contained as calcium hydrate merely, the strong heating would have driven it forth. Göpner's formula does not in any way account for the fusibility of the chloride of lime to a clear glassy mass at a moderately high temperature. A mixture of calcium hydrate, calcium chloride, and calcium chlorate does not possess this property. It is considered, therefore, that chloride of lime contains no calcium hydrate. Finally, the author considers it as proved, that chloride of lime has a constitution expressed by the formula, $2\,Ca\,H\,Cl\,O_2 + Ca\,Cl_2 + 2\,H_2\,O$. He also joins Fresenius in the view that the calcium chloride in this formula must be considered as standing outside the constitution of chloride of lime.

Whether the formula $Ca\,H\,Cl\,O_2$ or  $Ca{<}\begin{smallmatrix}O\,H\\O\,Cl\end{smallmatrix}$ gives the true situation of the atoms in the compound, or whether this formula should be doubled, the author will not decide. He contents himself with proving that the bleaching compound arises by the replacement of one atom of hydrogen in calcium hydrate by an atom of chlorine, and that the other atom of hydrogen remains in chemical combination. Finally, that the compound should be regarded as a calcium hydro-oxychloride.

Asparagin in Sweet Almonds. L. Portes. (*Répert. de Pharm.*, 1876, 641.) Having observed a peculiar crystalline crust on the outside of peeled almonds placed in absolute alcohol, the author made a series of experiments to ascertain the nature of this substance. It was found to be but little soluble in cold water; easily soluble in hot water, hot dilute alcohol, ammonia, acids and acid solutions; insoluble in strong alcohol, ether, and fixed oils. These properties, together with its composition, ($C_4\,H_8\,N_2\,O_3.\ H_2\,O$), and its crystallographic character, prove the substance to be asparagin.

Volumetric Estimation of Phenol. W. F. Koppeschaar. (*Zeitschrift für Analyt.-Chem.*, xv., 233.) The process generally employed for the estimation of phenol in the crude article of commerce is based upon the fact that the action of potassium hydrate on phenol results in the formation of a body soluble in water,—

$$C_6 H_5 O H + K O H = C_6 H_5 O K + H_2 O.$$

The crude substance is shaken in a graduated tube with a strong solution of caustic potash, and the mixture allowed to stand until the insoluble hydrocarbons have completely separated at the bottom; their volume is read off, and deducted from the volume of the crude phenol employed.

Having found this method to be untrustworthy, the author endeavoured to work out a volumetric process on the basis of the well-known reaction of phenol with bromine,—

$$C_6 H_5 O H + 3 Br_2 = C_6 H_2 Br_3 O H + 3 H Br.$$

According to Landolt, who first investigated this reaction, solutions of phenol containing but 1 part in 43,700 parts of water still produce a distinct turbidity on the addition of bromine water. As the washing and drying of the precipitated tribromophenol is a tedious operation, the reaction does not afford a handy gravimetric method. The author therefore preferred to employ an excess of weak bromine water, and to determine this excess volumetrically by potassium iodide, and standard solution of sodium hyposulphite. In the course of his experiments he found that nascent bromine, as liberated from a mixture of potassium bromide and bromate by hydrochloric acid, is preferable to bromine water. The mixture is produced by adding bromine in moderate excess to solution of potassium hydrate, and evaporating to dryness; the residue is then dissolved in water, and the available bromine determined in the solution by means of potassium iodide, hydrochloric acid, and sodium hyposulphite.

If the substance under examination be phenol containing water as the main impurity, it may be dissolved in cold water, and forthwith submitted to the test. But if the amount of phenol has to be determined in a sample of coal-tar creasote, containing many hydrocarbons, agitation with warm water in a flask is required to insure a complete solution of the carbolic acid.

The results obtained by the author are very satisfactory.

Volumetric Estimation of Magnesia in Potable Waters. L. Legler. (*Zeit. für Analyt.-Chem.*, xv., 425.) The method recommended consists mainly in the precipitation of the magnesium as hydrate by a known quantity of sodium or potassium hydrate, and the titration of the excess of caustic alkali by standard sulphuric acid. The reagents required are a solution of neutral potassium oxalate (to precipitate the calcium), decinormal solutions of caustic soda and sulphuric acid, and as an indicator one drop of rosolic acid. The *modus operandi* is as follows:—

The expulsion of free carbonic acid, and the complete decomposition of carbonates, are essential points in this process, and are best accomplished by mixing 100 c.c. of the water with decinormal sulphuric acid in moderate excess, and a drop of the indicator, allowing the mixture to stand for some time, then adding a slight excess of decinormal solution of sodium hydrate, boiling, and making careful gradual additions of standard acid to the boiling liquid, until it becomes permanently colourless. The number of c.c. of sulphuric acid used are calculated for carbonic acid or lime. Boiling the water with an excess of acid must be strictly avoided.

The water being thus freed from carbonates, is mixed with an excess of neutral potassium oxalate, and after complete precipitation of the lime, it is boiled with a known volume of decinormal $NaHO$, to effect the precipitation of the magnesia, and then made up to 150 c.c. by the addition of water. After filtering, the excess of soda is estimated in 100 c.c. of the filtrate by adding the standard acid in the same manner as before.

Magnesia may thus be estimated in waters containing only two milligrams of MgO per litre, besides indefinite quantities of lime and alkalies.

The complete removal of carbonates is necessary, as otherwise the calcium bicarbonate contained in the water would decompose the potassium oxalate, forming calcium oxalate and potassium bicarbonate, the latter of which would require an increased amount of sulphuric acid for neutralization, and thus cause a serious error in the analysis.

Estimation of Tannin. J. Löwenthal. (*Zeitschr. für Analyt.-Chem.*, xvi., 33–48.) The author describes the results of his experiments in the estimation of tannin, and considers that his improvements give determinations satisfactory for technical, if not for strictly scientific, purposes. The estimations of tannin from different sources (*e.g.*, sumach and nutgalls) are not comparable, but only those from sumach *inter se*, and from galls *inter se*.

Hammer's method is used, the extract being first titrated after adding indigo solution, so as to ascertain its potassium-permanganate value; the tannin is then precipitated from another portion of the extract, and the permanganate-value of the filtrate ascertained by the difference of these results.

For the precipitation of the tannin a solution of glue in water is made and saturated with common salt; it contains 25 grams of glue to the litre. After thoroughly mixing this with the tannin extract, a small quantity of dilute hydrochloric or sulphuric acid is added to assist the separation of the tannin; a vessel with narrow opening should not be used, as the precipitate coagulates into a mass. Of the tannin-extract to be titrated, sufficient is taken to require 0·06 to 0·08 grams of permanganate; 10 grams of sumach are extracted with boiling water, and after cooling, the liquid is made up to 2 litres. To 100 c.c. of this solution 100 c.c. of the glue solution are added, and to this mixture are further added 50 c.c. of water containing 5 c.c. of $H\,Cl$ (1·12 sp. gr.), or 2 to 2·5 grams of $H_2\,S\,O_4$. The slight reducing action of the glue solution upon the permanganate may be safely neglected; the error due to this cause is less when Hammer's powdered skin (*hautpulver*) is employed. This error almost vanishes if four-fifths of the glue solution directed to be added is replaced by a saturated solution of common salt. The presence of indigo solution is necessary, not only as an indicator, but it also prevents the oxidising action of the permanganate extending to any substances in the extract less readily oxidisable than the indigo is itself. The only requisite for making this method quite accurate is the separation of pure tannin and the determination of its permanganate-value; this would ensure the accurate calculation of the quantity of tannin from the difference of permanganate-values. The separation of tannin from its lead-compound by addition of insufficient oxalic acid yielded much purer tannin than the separation by sulphuretted hydrogen.

The sample in which tannin is to be estimated is never dried before being weighed, as it is sold in the undried state. Oser's recommendation to add acid during the titration of the indigo solution has been accepted by the author. The determination of glue by precipitation with an excess of tannin, which excess is afterwards titrated, is inexact. Since the quantity of tannin combining with a certain quantity of glue increases with the quantity of tannin present, the author intends to examine the effect of using sodium-chloride solution in place of water. Hydrochloric acid is preferred to sulphuric for acidifying. The statements of Wagner that gall-tannin combined with glue putrifies, and that in turkey-red dye works sumach is never used without galls, are not confirmed by the author's experience.

Volumetric Estimation of Alcohol. T. T. Monell. (*Chem. and Drugg.*, Dec., 1876, from *Amer. Chem.*) If a cobalt salt be added to an alcoholic solution of sulpho-cyanide of ammonium, a deep blue coloration is produced, which suddenly vanishes on dilution with water, and reappears on further addition of alcohol. Given the same volume, spirit of a certain percentage always gives precisely the same intensity of colour with a standard blue solution in whichever order alcohol or water may be added. It is possible in this way to determine quickly, by a volumetric process, even so little as one-fourth per cent. of alcohol in a mixture. A measured quantity of the dark blue standard fluid is placed in a cylinder, and a mixture to be tested is added until the colour is reduced to that of a strip of pale blue glass; the volume of this pale coloured fluid will be the greater as the mixture is richer in alcohol. This volume, once determined, will always remain the same, and the percentage noted on the cylinder may afterwards be read off without further trouble. The standard fluid is always prepared with the spirit of the same strength, and compared with the same strip of blue glass. The nitrate of cobalt is the salt found most convenient for this purpose. Coloured brandy may be tested directly; in this case the tint is not blue, however, but green. Two cylinders are therefore necessary,—one for the test, and one to give the desired tint in conjunction with the blue glass. The cobalt solution may be either neutral or slightly acid, but should contain as little water as possible.

Cyclamin, or Arthanatin. (*Pharm. Centralhalle*, 1877, 18.) This glucoside is mentioned by Professor de Luca as a substitute for curare, and recommended by him as a remedy against tetanus. It is contained in the tubers of *Cyclamen Europæum*, a native of central and south-eastern Europe, belonging to the natural order *Primulaceæ*. According to Saladin, the fresh tubers are collected in autumn, crushed into a pulp, and digested with a small quantity of water. The solution is evaporated at a temperature not exceeding 60° C. to the consistence of a syrup, the residue exhausted with absolute alcohol, the alcoholic solution decolorized with animal charcoal, and allowed to evaporate spontaneously in a warm place.

Cyclamin thus prepared forms white odourless crystals having a very acrid taste. It is readily soluble in water and alcohol, but insoluble in ether, chloroform, and carbon bisulphide. The aqueous solution, according to De Luca, froths like a solution of soap; and when heated to 60°–70° C., it separates the cyclamin in a coagulated form. With concentrated sulphuric acid it forms a yellow solution, passing gradually to violet. When boiled with dilute mineral acids it is split up into glucose and a resinoid substance called cyclamiretin, which is insoluble in water and in ether, but soluble in alcohol. The same decomposition is effected by emulsin at 30°–35° C.

The formula of cyclamin was ascertained to be $C_{20}H_{34}O_{10}$.

According to Pelikan, who administered this substance to frogs, both internally and by subcutaneous injections, it belongs to the irritant poisons. Schroff observed that the toxic symptoms following the internal administration of 0·2 gram passed off in the course of an hour.

The Detection of Bile in Urine. O. Rosenbach. (*Med. Centralblatt.*) Urine containing bile, when passed through white filtering paper, imparts a yellow or brown colour to the paper. On allowing one drop of strong nitric acid to run down the side of the moist filter, it leaves a yellow streak, soon changing to orange, with a violet border, on the outside of which blue and emerald green zones may be observed: these colours remain visible for some time. Dark coloured urine, owing its tint to substances other than bile, do not produce this play of colours.

The Detection of Sulphur in Organic Compounds. H. Vohl. (*Ber. der deutsch. Chem.-Ges.*, ix., 875.) The tests generally applied for the detection of sulphur in organic substances afford no means of distinguishing between sulphur, as such, and its oxygen compounds. The author's process is not open to the same objection, as it is based upon a reaction which is not shared by these oxygen compounds.

The test solution is prepared by introducing freshly prepared calcium hydrate, in small quantities at a time, into a flask containing a mixture of two volumes of pure glycerin and one volume of distilled water, until a saturated solution is obtained; then adding hydrate of lead, or finely powdered litharge, in excess; boiling the mixture for a few minutes, allowing it to settle in the closed flask, and decanting the clear liquid from the sediment.

Organic substances containing sulphur, such as hairs, feathers, nails, horn, albumen, blood-serum, etc., when heated with this solution, are blackened, owing to the formation of sulphide of lead. Volatile compounds require to be heated with the reagent in a sealed tube to 105°–110° C. for several hours.

The test is a very delicate one, as may be seen from the fact that wheat bread, when boiled with the reagent, assumes a yellow and afterwards a grey colour, the reaction being due in this case to the trace of sulphur contained in the gluten of the wheat. Blood stains on linen, and also the stains of seminal fluid, are blackened on being moistened with the reagent and heated to 100° C.

Solutions of hydrate of lead in caustic potash or soda will, of course, produce the same effect; but they are not so well suited for this test, on account of the yellow or brown coloration which the caustic alkalies impart to many organic substances.

Impurities in Wood Charcoal. M. Jaillard. (*Journ. de Pharm. et de Chim.*, xxv., 121.) Vegetable charcoal frequently contains organic impurities which have escaped destruction during its preparation. The commonest of these is acetate of potash, of which the author has found some samples to contain as much as 0·3 per cent. Such a charcoal requires to be heated to redness in a closed vessel to free it from its organic constituents.

Preparation of Pure Potassium Cyanide. E. Erlenmeyer. (*Zeitschr. des oesterr. Apoth. Ver.*, 1877, 210, from *Ber. der deutsch. Chem.-Ges.*) The process of fusing a mixture of ferrocyanide and carbonate of potassium yields a preparation containing a considerable amount of cyanate, which is difficult to remove. By using metallic potassium in place of the carbonate, the formation of cyanate is completely prevented, and a pure cyanide obtained. As cyanide of sodium, or a mixture of cyanide of potassium and sodium, will serve for most of the purposes for which the potassium salt is generally employed, the author suggests the use of metallic sodium (as being much cheaper than potassium) for the preparation of a pure alkaline cyanide. The composition of the product thus obtained would be represented by the formula $2\,K\,Cy + Na\,Cy$.

The Determination of Soda in Pearl Ash by Indirect Analysis. G. C. Wittstein. (*Zeitschr. des oesterr. Apoth. Ver.*, 1877, 207.) In estimating the potassium and sodium in a mixture of their carbonates by the so-called indirect method, it was hitherto the rule first to convert these carbonates into chlorides or sulphates. This the author shows to be unnecessary, as the relative proportions of the two carbonates may be equally well calculated from the quantity of carbonic acid which the mixture is found to contain. If the carbonic acid ($C\,O_2$) amounts to more than 31·80 per cent., or to less than 41·47 per cent., the alkaline carbonate under examination can neither be pure potassium carbonate, nor pure sodium carbonate, but must be a mixture of the two, the composition of which can be ascertained by the following calculation:—

To find the per centage of potash ($K_2\,O$), multiply the weight of the two bases (the total weight of the carbonates minus that of CO_2) by 1·708763, deduct the product from the weight of the carbonates, and divide the rest by − 0·242663.

To find the percentage of soda (Na_2O), multiply the weight of the bases by 1·466100, deduct from the product the weight of the carbonates, and divide the rest by − 0·242663.

Reactions of Trimethylamine with Solutions of Metallic Salts. C. Vincent. (*Bull. de la Soc. Chim. de Paris*, 1877, 194.) The addition of an aqueous solution of trimethylamine to metallic solutions produces the following reactions:—

Magnesium Salts.—With neutral solutions of magnesium salts the reagent produces a white permanent precipitate; no precipitation occurs with acid solutions, but on the subsequent addition of sodium phosphate, a white amorphous precipitate is formed, which gradually becomes crystalline.

Beryllium Salts.—White permanent precipitate.

Aluminium Salts.—Gelatinous precipitate, soluble in an excess of the reagent.

Zirconium Salts.—White permanent precipitate.

Cerious Salts.—White permanent precipitate.

Ceric Salts.—Reddish white permanent precipitate.

Ferrous Salts.—Dirty white permanent precipitate.

Ferric Salts.—Brown permanent precipitate.

Chromium Salts.—With green solutions, a grey permanent precipitate; with violet solutions, a bluish green one.

Manganous Salts.—White precipitate, turning brown on exposure to the air. The precipitation occurs also with acid solutions.

Cobalt Salts.—Bluish grey permanent precipitate.

Nickel Salts.—Pale green permanent precipitate.

Uranium Salts.—Yellow permanent precipitate.

Zinc Salts.—White permanent precipitate.

Stannous Salts.—White permanent precipitate.

Stannic Salts.—White permanent precipitate, soluble in an excess of the reagent.

Bismuth Salts.—White permanent precipitate.

Lead Salts.—With lead nitrate a white precipitate, soluble in an excess of the reagent. With lead acetate, no precipitate.

Cupric Salts.—Greenish blue permanent precipitate.

Mercurous Salts.—Black permanent precipitate.

Mercuric Salts.—Yellow permanent precipitate; with mercuric chloride the reaction is the same as with other mercuric salts.

Silver Salts.—Dark grey precipitate, soluble in a large excess of the precipitant. Silver chloride is completely insoluble in trimethylamine.

Palladium Salts.—Brown precipitate, soluble in an excess of the reagent.

Gold Salts.—Pale yellow precipitate, also soluble in an excess.

Platinum Salts.—Yellow precipitate, soluble in hot water, and crystallizing from the solution on cooling.

The Detection of Nitrates in Potable Waters. A. Vogel. (*Neues Repertor. für Pharm.*, xxiv., 666.) The author employs leaf gold for the detection of nitrates in potable water. 20 c.c. of the water to be tested are evaporated in a porcelain dish, with gold leaf and a few c.c. of pure hydrochloric acid. If nitrates are present, some of the gold will be dissolved, and may be detected in the solution by stannous chloride; or if the quantity of nitrates is not too small, by the yellow colour of the solution. The advantage of this method consists in the non-employment of sulphuric acid, the impurities of which (nitric acid, and oxides of nitrogen) are a very common source of error in testing for traces of nitrates.

Preparation of Pure Hydriodic Acid. H. Kolbe. (*Journ. f. prakt. Chem.*, xv., 172.) One part of ordinary phosphorus is gradually added to ten parts of iodine in a retort filled with carbonic acid gas; the resulting liquid is heated for a short time, then allowed to cool, mixed with four parts of water and distilled. The acid thus obtained is colourless and free from uncombined iodine. The application of larger proportions of iodine and water, as recommended in "Gmelin's Handbuch," and other works, results in the production of a much weaker acid, which moreover always contains free iodine.

Volumetric Determination of Carbonic Acid. G. W. Wigner. (*Analyst*, i., 158; *Journ. Chem. Soc.*, 1877, 218.) Most laboratories are now furnished with the McLeod apparatus, or some similar efficient apparatus, for measuring the volume of gases under known conditions of temperature and pressure. The author has therefore devised a simple apparatus for the decomposition of carbonates, and the measuring of the gas evolved. A test-tube of about 7 inches by 1 inch is taken and provided with a good india-rubber stopper bored with two holes. Through one of these holes a tubulated, thistle-headed funnel of small size, furnished with a stop-cock, is passed, and through the other a bent piece of small-bore glass-tubing, also provided with a stop-cock. This bent tube is coupled to the McLeod or other gas-measurment apparatus by a short length (6 inches) of very stout, small-bore india-rubber tube ($\frac{1}{16}$ inch is large enough for the bore of this). In the bowl of the thistle-funnel a glass marble is put, and in the interior of the test-tube a smaller test-tube of about 2 in. × $\frac{3}{8}$ in., containing the sample to be analysed. The process is as follows:—The tubes of the McLeod apparatus are filled with mercury and the stop-cocks closed. The sample (say 25 grams of carbonate of lead) is weighed and transferred to the smaller tube, and about half an ounce of distilled water is poured into the large test-tube. The small tube is then carefully dropped in, taking care that its mouth is above the level of the water in the large tube; the stopper into which the funnel and bent tube have been inserted is then carefully put in place, and the whole held in a slightly oblique position in a retort-stand clamp, on the ordinary rising table of the McLeod apparatus. The india-rubber tube is then coupled up to the facets of the measuring-tube of the McLeod apparatus. The stop-cock on the bent tube is closed, after having opened it and the cock on the funnel-tube in order to liberate any excess of air in the india-rubber tube, and the mercury in the measuring-tube is allowed to fall, so as to produce a vacuum. The stop-cock on the funnel remains open, and to the bottom of the test-tube a lamp is applied until the water boils briskly, when distilled water is poured into the funnel and kept from running into the test-tube by the pressure of steam; the boiling is continued until the steam escaping through the funnel and under the glass marble all condenses, showing that the tube is filled with pure steam. The lamp is now withdrawn and the stop-cock instantly closed. Meanwhile a portion of dilute nitric acid has been boiled on another burner, and is poured into the funnel. The stop-cocks on the bent tube and on the measuring-tube are opened, and then the stop-cock on the funnel-tube is cautiously opened. The hot acid of course runs in, and the only precaution necessary is to avoid liberating the gas too quickly. When the test-tube is about two-thirds full, and all effervescence has ceased, the solution in the tube is again boiled, and then, still maintaining a partial vacuum by means of the mercury, the tube is filled completely through the funnel-tube with boiling distilled water, until every bubble of air is driven into the measuring-tube of the McLeod apparatus. The stop-cock on the bent tube is then shut, and the mercury in the pressure-tube and the measuring-tube brought to the same level. This brings the internal pressure of the air on the short india-rubber connecting tube to the atmospheric pressure, and as its volume does not exceed 1 c.c. the correction for its temperature may be safely omitted. The gas is then measured in the ordinary way, and its volume calculated to weight and percentage.

It is easy to make four determinations of carbonic acid per hour by this apparatus, and the accuracy of the results is very great.

Determination of Morphine in Opium. E. F. Teschemacher. (*Chem. News*, xxxv., 47; *Journ. Chem. Soc.*, 1877, 231.) In employing the following method, the use of alcohol to extract the morphine is avoided, and meconic acid is separated at an early stage, which prevents the formation of a basic meconate on precipitation of the morphine. Two special reagents are required for this process: the one prepared by mixing 1 part of solution of ammonia, sp. gr. 0·880, with 20 parts of methylated alcohol and digesting in this mixture a large excess of morphine, this when filtered is termed "*morphiated spirit;*" the other, "*morphiated water,*" is water saturated with excess of morphine, and contains 0·04 per cent. of this alkaloid.

1000 grains of opium are macerated for twelve to twenty hours in about 4000 grains of cold distilled water, together with 300 grains of lead acetate, stirring the mixture from time to time. This separates the meconic acid as lead meconate, whilst the morphine is dissolved in the acetic set free.

After this maceration the opium may be readily ground in a mortar to a paste, and so much more cold distilled water added (rinsing the pestle and mortar with successive portions of it) as to fill with the mixture a measure = 20,250 grains of distilled water: experience has shown that the space occupied by the insoluble matters measures from 200 to 300 grains, so that the limit of possible error, by averaging and allowing 250 grains for the insoluble portion, amounts to 0·05 per cent. in opium containing 10 per cent. of morphine. The mixture is to be filtered and 15,000 measured grains (= 750 grains of opium) of the clear solution are to be evaporated to an extract on a water bath, and this residue to be drenched with 3090 grains of boiling alcohol or methylated spirit, and the whole digested, with frequent stirring, for about ten minutes. This separates the gum, etc., of the opium, which is insoluble in alcohol, and so far frees the solution of morphine from impurity. At this stage of the process it is well to get rid of the excess of lead-salts, and for this end sulphuric acid is preferable to sulphuretted hydrogen. So much diluted sulphuric acid as may be equal to 30 grains of oil of vitriol will almost always be sufficient for this purpose, any excess of acid being converted into sulphate of ammonia by the subsequent addition of so much solution of ammonia as shall be equivalent to the 30 grains of oil of vitriol, thus forming a salt but slightly soluble in the alcoholic solution. This mixture may now be transferred to a beaker and allowed to settle for twelve hours, after which it is to be filtered, and the filter and insoluble residue thoroughly washed with alcohol or methylated spirit. This alcoholic filtrate is then distilled, or evaporated on a water bath, to about 1000 grains; and mixed, while still hot, with 400 grains of solution of ammonia, sp. gr. 0·880, stirring rapidly and continuously for at least twenty minutes, whilst the beaker or evaporating dish should be cooled as rapidly as possible, by immersion in an external vessel filled with cold water. The rapid and continuous stirring is most important, as the precipitation of the whole of the morphine *in fine powder* is thereby effected, instead of the granular or mammillated condition so frequently met with, and it thus permits of the easy and thorough separation of all the narcotine which may be mixed with the morphine. When the cooling of the mixture and precipitation of the morphine is thus attained, transfer it quickly and completely to a filter of sufficient capacity to hold the whole, and when the liquid portion has passed through, wash the remainder of the precipitated morphine adhering to the dish or beaker on to the filter, using for this purpose the morphiated spirit already described, and continuing the washing of the precipitate until it is completely freed from the mother-liquor. To do this effectually requires some little care: thus the morphine on the filter must be kept in a spongy condition and never allowed to cohere, which is easily effected by pouring the morphiated spirit round the edges of the filter so as not to disturb the precipitate, which must not be permitted to drain or solidify until this washing is completed.

The precipitate is now to be washed from off the filter-paper with the morphiated water previously described, and digested therein for a few minutes, which removes some more colouring matter together with any salts soluble in water but insoluble in alcohol, which may have adhered to the precipitated morphia; then once more collect the precipitate on a filter, washing it with morphiated spirit, after this once with ether, and finally thrice or more with benzin; this completely frees it from narcotine, which is very soluble in benzin, morphine on the contrary being insoluble in this liquid. It now remains to drain and dry at a low temperature, say 100° F., the resulting pure and white morphine, the weight of which will indicate the amount of this alkaloid present in 750 grains of the opium under examination.

Extraction of Caffeine from Guarana. Dr. F. V. Greene. (*Amer. Journ. Pharm.*, 1877, 338.) In determining the percentage of caffeine in guarana by Stenhouse's process (see *Pharm. Journ.*, 1st series, xvi., 212), the author experienced some difficulty in separating the solution from the portion insoluble in boiling water, and found the washing of the mass precipitated by lead acetate a very tedious operation. He therefore attempted the separation of the alkaloid by means of litharge, which substance has been recommended by Prof. E. S. Wayne for the extraction of caffeine from coffee and tea. The results proved that in the case of guarana, too, this process affords a ready means for the isolation and estimation of the alkaloid.

The details of the method are as follows:—The powdered guarana is intimately mixed with three times its weight of finely divided litharge, and the mixture boiled in distilled water, the ebullition being continued until, on allowing the temperature to fall below the boiling point, the insoluble portion is found to subside rapidly, leaving the supernatant liquid clear, bright, and without colour. The quantity of distilled water required will be found to be about a pint for every fifteen grams of the guarana used in the experiment, and, as the boiling has to be continued for several hours before the desired and all essential separation mentioned above takes place, water must be added from time to time to supply the place of that lost by evaporation. When cool, the clear liquid is decanted upon a filter, and when it has passed through, which it will be found to do with facility, the precipitate is to be transferred to the filter and washed with boiling water, the washing to be continued as long as yellowish precipitates are produced with either phosphomolybdic acid solution, auric, or platinic chloride. A stream of sulphuretted hydrogen gas is now passed through the filtrate to remove the small quantity of lead that has been dissolved and the sulphide thus formed separated by filtration. The solution is evaporated on a water bath to expel the excess of sulphuretted hydrogen, filtered to remove a trace of sulphur, finally evaporated to the crystallizing point, and the caffeine, which crystallizes out on cooling, removed from the mother liquor and pressed between folds of bibulous paper. After being thus treated, the crystals will be found to be perfectly white. On diluting the mother liquor with distilled water, filtering and evaporating, a second crop of crystals are obtained, which are also perfectly white, after being pressed as above. The crystals are now dissolved in boiling diluted alcohol, filtered, and the solution set aside to crystallize by spontaneous evaporation. The resulting crystals of caffeine are perfectly pure and colourless.

In order to test the accuracy of the process, fourteen grams of guarana in an impalpable powder were treated with the utmost care, as above described. The extracted caffeine, after drying at 100° F. until the weight became constant, was found to weigh ·707 grams, 5·05 per cent., a remarkably close approximation to the results of Stenhouse, who from 25 grams of guarana, obtained 1·260 grams of caffeine = 5 04 per cent., and from 14 grams 5·1 per cent. Average = 5·07.

As this method of extracting caffeine is entirely devoid of all complicated steps, and requires but a short space of time for its completion, it may be used advantageously in estimating the percentage of caffeine in the fluid extract of guarana, which is now frequently prescribed.

Rapid Preparation of Caffeine. O. Caillol and P. Cazeneuve. (*Bull. Soc. Chim.*, 1877, 199.) Caffeine is generally prepared from tea, as it is contained therein in larger quantities than in coffee. According to the usual method, the tea is exhausted with water, the infusion precipitated by lead acetate, the filtrate freed from lead by sulphuretted hydrogen, and evaporated; the crystals thus obtained are purified by decolorization with animal charcoal and recrystallization.

The authors have attained a better result by the following more rapid process:—Black tea is thoroughly softened with four times its weight of hot water; a quantity of calcium hydrate equal to that of the tea used is then added, and the whole evaporated on a water bath to perfect dryness. The dry residue is exhausted with chloroform in a displacement apparatus, and the chloroform recovered from the percolate by distillation. The residue left in the retort is a mixture of caffeine and a resinous substance containing chlorophyll. On treating it with hot water, filtering, and evaporating the filtrate on a water bath, the caffeine is obtained in perfectly white silky crystals.

Improvements in the Manufacture of Sodium Carbonate. Dr. H. Hager. (*Pharm. Centralhalle*, 1877, 42.) The preparation of carbonate of soda by the so-called ammonia process, though comparatively new, is already undergoing important modifications. Hitherto the main step in the process was the formation of sodium bicarbonate (see *Year-Book of Pharmacy*, 1874). The latest modification is based upon the comparative insolubility of the monohydrated sodium carbonate, $Na_2\,C\,O_3.\,H_2\,O$, in a concentrated solution of common salt. The ordinary carbonate, usually containing 10 molecules of water of crystallization, when recrystallized at 35° C. contains but seven molecules, and when crystallized at 60°–70° C. it contains but one molecule of water. The action of the ammonium carbonate upon the sodium chloride is explained by the following equation:—

$$2\,Na\,Cl + (N\,H_4)_2\,C\,O_3 = Na_2\,C\,O_3 + 2\,N\,H_4\,Cl.$$

Dialysed Iron. A. and H. C. Blare. (*Amer. Journ. Pharm.*, 1877, 340.) This preparation has attracted the attention of many members of the medical and pharmaceutical professions for some time past, and the experience resulting from its use is so satisfactory that it promises to become one of the most valued therapeutic agents in a large class of diseases where the ordinary iron preparations are objectionable. The writers obtained the following formula from a prominent French chemist who has been extensively engaged in the manufacture of this remedy:—

Take 10 parts liq. ferri per. chlor. (B. P.), precipitate by aqua ammoniæ, and wash the precipitate thoroughly. Mix this with 12 parts of liq. ferri per. chlor. (B. P.), and place in a dialyser. The dialyser is placed in a suitable vessel with distilled water, the water under it renewed every 24 hours. The operation is continued until the dialysate ceases to contain chlorine, at which time the preparation is found to be neutral. It usually takes from 12 to 15 days to complete the process.

The resulting preparation is, or should be, of a deep dark red colour, and contains about 5 per cent. of the oxide of iron. As to the chemical condition of the iron in solution, M. Bravais, of Paris (who claims to produce the only genuine), says, "It consists of liquid peroxide of iron, *i.e.*, iron merely united with oxygen and water to the exclusion of all acids;" but it is, no doubt, in fact a neutral solution of an oxychloride of iron in a concentrated form, and the theory of its production is nothing new, and is very simple. The oxychloride (which is the substance retained in solution in the dialyser) is a colloidal substance. The chloride (which is the principal substance rejected, or washed out as it were) is a crystalloidal substance. These two substances—crystalloid and colloid—are separated by dialysis, the former from the latter by diffusion through a septum, such as parchment paper.

Other formulæ more recently have been suggested, differing somewhat from the above, and it has been the subject of no little discussion abroad as to the particular merits of the one or the other of these. By some it has been suggested to pursue the following formula:—Take a given quantity of liq. ferri perchlor. (B. P.), and precipitate by ammonia; wash well the precipitate, and mix with sufficient quantity of the same preparation of liq. ferri perchlor. to saturation, and dialyse. It is remarkable how large a proportion of this freshly precipitated sesquioxide of iron will be taken up or dissolved. For example, the precipitate obtained from one pint of our officinal liquor ferri chlor., representing 3 ounces and 6 drams of dry oxide, is entirely taken up by about 5 fluid ounces of the same liquor. In the magma this precipitate seems a very great quantity, so bulky is it; and, as stated before, it is quite surprising to see it disappear into solution under the influence of so small a quantity of the liquor.

By following the above method the process is shortened considerably. It became thoroughly dialysed in one week, while the other takes about twice that time.

Still another method has been suggested, namely, to take a given quantity of the liquor ferri chlor., and add aqua ammoniæ almost enough to produce the precipitate of the sesquioxide. When the precipitating point is reached the whole solution is placed in the dialyser. The chloride of ammonium is thus extracted from the solution, and the peroxide of iron, or oxychloride, retained.

If either of these processes is pursued carefully, the same result will be obtained. If the solution, after completion of the operation, should contain more than 5 per cent. of iron, it may be diluted with distilled water till it reaches that point. There are some dialysed irons in the market containing no more than from 3½ to 4 per cent. When the preparation has become thoroughly dialysed, it is tasteless and neutral; the operation should then be discontinued, as by further dialysis the liquid is converted into a gelatinous condition.

The above formula furnishes an article precisely similar to the original Bravais' dialysed iron, which the authors have imported and had ample opportunity for comparison. They found that it can be produced for about one-half the cost of the imported.

The manner of taking the pure concentrated dialysed iron is generally in drops, ranging from 15 to 50 daily, in divided doses, on sugar or in sugar and water; suitable vehicles can be used for administration without fear of decomposition. Being without taste and odour, compatible with syrup and alcohol, and communicating no taste to any suitable vehicle, it is easy to construct formulæ for elixir, syrup, etc.; a glycerite is stated to be an excellent preparation.

Dialysed Iron. J. M. Maisch. (*Amer. Journ. Pharm.*, 1877, 342.) Dialysed iron, which will doubtless become one of the most valuable ferruginous medicinal agents, has been recently introduced into the United States, under various names. Some claiming it to be a solution of *oxide of iron* in water, it was, and is still frequently called in Europe, *ferrum oxydatum dialysatum;* but like the very similar preparation, *ferrum oxydatum saccharatum*, which has been made officinal in several European pharmacopœias (*Amer. Journ.*

Pharm., 1873, p. 161; 1874, p. 559), it is nothing more nor less than a very basic oxychloride of iron. To prevent erroneous conceptions concerning its composition gaining a foothold, a brief review of the earlier literature on the subject will not be out of place.

The first paper on this subject deserving notice is one by John M. Ordway, entitled "Examination of the Soluble Basic Sesquisalts," which was published in the *American Journal of Science and Arts*, 2nd series, xxvi., 197 (1858), and in which the following language is used: "Time is a very important element in the production of the highly basic compounds. One may easily be deceived as to when the hydrate ceases to be dissolved, and may set down as opaque that which by longer digestion becomes quite transparent. By successive steps we get pretty easily as far as $Fe_2\,Cl_6.\,11\,Fe_2\,O_3$, and in the course of several weeks I have gone as high as $Fe_2\,Cl_6.\,23\,Fe_2\,O_3$."

The next important paper is by Béchamp (1859), published in *Annales de Chimie et de Physique*, 3rd series, lvii., 296, which in the main corroborates the statements of Ordway, but gives the most basic compound obtained $Fe_2\,Cl_6.\,20\,Fe_2\,O_3$. In both cases the solutions of the normal salt were digested with ferric hydrate.

Th. Graham's celebrated essay on the diffusion of liquids (*Phil. Trans.*, 1861, 183) announces the following results:—"If recently precipitated ferric hydrate or carbonate of ammonium is added to an aqueous solution of ferric chloride, as long as the precipitates are redissolved, and if the dark red solution thus obtained, containing from 4 to 5 per cent. of solid matter, is subjected to dialysis, mainly muriatic acid will pass through the septum, upon which, after 19 days, remains a red liquid containing for 98·5 parts of oxide 1·5 part of muriatic acid. It remains liquid for 20 days and then gelatinizes, separating ferric hydrate. A similar solution of colloidal ferric hydrate may be obtained by dialysis of ferric acetate, and contains 6 parts of acetic acid to 94 parts of ferric oxide."

Calculating Graham's results as an oxychloride, the formula $Fe_2\,Cl_6.\,95\,Fe_2\,O_3$ would be obtained, which seems to be hardly probable. At the same time, it must be remembered that none of the so-called soluble oxide of iron has as yet been obtained free from acid. Graham's figures are the lowest thus far observed, and the solution was not permanent, but gelatinized spontaneously. It must therefore be granted that any permanent solution of so-called soluble oxide of iron must contain notable quantities of acid; and within the past year such has been proved by Hager to be the case with several European preparations sold as oxide of iron.

The behaviour of the solutions is quite curious and apt to mislead, unless care be taken to arrive at correct results. They will retain their clearness on boiling, are miscible with alcohol, glycerin, syrup, etc., but readily yield precipitates on the addition of acids not in excess, or of saline solutions, the precipitates disappearing again on diluting with distilled water. Tannin added in small quantities darkens the solution somewhat, and on filtering leaves but little matter in the funnel; on using a stronger solution of tannin a well diffused gelatinous precipitate takes place, having a deep brown, but not a black colour, and the filtrate is colourless. Solution of nitrate of silver added in small quantity does not disturb the transparency of the liquid; on adding more of the former a gelatinous *brown* precipitate takes place, and the colourless filtrate is free from iron, but the addition of distilled water causes the precipitate to dissolve again. Apparently, therefore, the solution is free from chloride: but on adding first a slight excess of ammonia, filtering from the ferric hydrate, acidulating with nitric acid, and then testing with nitrate of silver, a white precipitate of chloride of silver is formed. All these reactions as well as the slight astringent, not inky taste, and the intense brown-red colour have been observed by the investigators named above, and they characterize also the commercial products. A sample recently examined by the writer, and said to contain no, or only traces of, chlorine, yielded when treated as above abundant evidence of its presence.

Physicians and pharmacists should therefore bear in mind that there is *no soluble oxide of iron;* but what is sold as such, be it imported or made in this country, is *very basic oxychloride of iron.* This being the case, the question naturally presents itself, whether such a solution cannot be obtained by saturating a solution of ferric chloride with hydrate of iron? That question is easily answered if the behaviour of saline solutions is taken into consideration and the fact is remembered that, when solutions of ferric salts are precipitated by alkalies, the ferric hydrate will invariably retain small quantities of the precipitant, which cannot be removed by washing with water. These saline impurities, minute as they may be, are sufficient to prevent the formation of the very basic oxychloride; or if formed it becomes insoluble in the liquid, and nothing but dialysis or considerable dilution with distilled water can dissolve it again. To obtain it of the maximum strength indicated by Graham (5 per cent.) and also adopted by the Pharmaceutical Society of Paris, dialysis appears to be unavoidable.

As to the advantage of the dialysed over the oxychloride made by saturation with hydrate of iron, that is best ascertained by comparing their taste, which in the former is scarcely astringent, while that of the latter is distinctly ferruginous. A preparation imported from Germany, called ferrum oxydatum dialysatum, which was received and examined by the author, appeared to have been made by saturation alone, or by incomplete dialysis; for its reaction is distinctly acid and its taste quite styptic. Some French preparations, sold by the same name, were found to be superior to the German in both respects; but one yielded only 3·3 per cent. of solid matter, another less than half that quantity. A 5 per cent. solution of dialysed iron should yield 3 grains of dry residue when 60 grains of it are carefully evaporated to complete dryness.

The characteristics of a 5 per cent. solution of dialysed iron may be stated to be—

1. The deep brown-red colour, which in thin layers is perfectly transparent.
2. The freedom from odour and taste, it being merely faintly astringent to the palate.
3. The absence of even slight acid reaction to test paper; and
4. The behaviour to tannin and to saline solutions (even spring water), as stated above.

It is best given by itself upon sugar, or mixed with some simple syrup which is free from acid. It should be mentioned yet that the same preparation has made its appearance in Austria as *catalytic iron*.

Note upon a Reaction of Emetine. F. B. Power. (*Amer. Journ. Pharm.*, 1877, 391.) A solution of chlorinated lime produces with emetine a bright orange or lemon yellow coloration, and is conveniently employed by touching a trace of the alkaloid, upon a porcelain plate with a drop of the alkaline solution: the reaction being much favoured by the addition of a drop of acetic or other weak acid, to insure the liberation of the hypochlorous acid, upon which the reaction apparently depends, as chlorine is incapable of producing the coloration, which is permanent and may be quite indefinitely retained.

A few drops of a solution of one part of emetine, in 1000 parts of water, when evaporated to dryness and brought in contact with a drop of the alkaline solution, readily produces the coloration; and with a solution containing one part of the alkaloid in 5000 parts of water, the yellow coloration is still perceptible.

In view of the isolation of the alkaloid when mixed with complicated organic substances, it must be remembered that it is not absorbed from acid, but very readily from alkaline solutions by amylic alcohol, chloroform, benzol, and petroleum benzin.

The reaction may also be employed as a means of testing the value of various species of ipecacuanha. If a gram of the root of *Cephælis ipecacuanha* in fine powder, or the cortical portion therein contained, be treated according to the process described by Prof. Flückiger for the isolation of emetine, *i.e.*, mixed with a small amount of quicklime and a few drops of water, the mixture allowed to dry upon the water bath, subsequently exhausted by chloroform, and the filtrate allowed to evaporate in a capsule containing a few drops of dilute acetic acid, the nearly colourless residue thus obtained affords with the alkaline solution the characteristic coloration.

The root of *Richardsonia scabra*, Lin., or undulated ipecacuanha, which is occasionally quoted as a source of emetine, when similarly treated does not produce this reaction, a fact which may confirm the supposition already entertained, that this root is destitute of alkaloid.

Detection of Sugar in Glycerin. A. Schillberg. (*Pharmaceut. Centralhalle*, 1877, 115.) Pure glycerin when boiled with an equal volume of hydrochloric acid (containing about 25 per cent. of HCl) remains colourless; but if the least admixture of sugar be present, a yellow or yellowish red coloration is produced. The glycerin takes no part in the reaction, as the same coloration is produced on heating a weak aqueous solution of sugar with the acid. According to the author this reaction is the same which W. W. Stoddart considered to be due to the colouring matter of saffron (see *Year-Book of Pharmacy*, 1876, 494).

Cochineal Testing. J. M. Merrick. (*Zeitschr. für Analyt.-Chem.*, xv., 493.) In determining the value of a sample of cochineal by titration of its colouring matter with potassium permanganate, as previously described by the author (*Zeitschr. für Analyt.-Chem.*, xi., 230), it should be understood that there is a marked difference between black and silver cochineal in their behaviour with the reagent named. If permanganate be added to solutions of the colouring matter of the two kinds until both show the same yellow colour, no further change will be observed for some time in either; but if the mixtures be allowed to stand for 8 to 12 hours, that obtained from the black cochineal will appear deep red, whereas the other remains still unaltered. To avoid errors it is necessary, therefore, to keep standard samples of both kinds of cochineal, so that the sample tested may be compared with a sample of its own kind.

Sclerotic Acid. The Preparation and Properties of Sclerotic Acid. Prof. G. Dragendorff and M. Podwissotzky. (*New Remedies*, from *Pharm. Zeit. für Russland*, 1877, No. 5.) In a previous report on the constituents of ergot (a summary of which will be found in the *Year-Book of Pharmacy*, 1876, p. 247), the authors announced the isolation of a proximate principle of an acid character, possessing in a high degree the physiological properties of the drug. In a more detailed report of their researches subsequently published. they furnish a full account of their method of preparing this principle, which they have named "sclerotic acid."

Very finely powdered ergot is exhausted with distilled water, the solution concentrated *in vacuo*, and the residuary liquid mixed with an equal volume of 95 per cent. alcohol. This causes the precipitation of a peculiar slimy substance, scleromucin, together with a portion of the salts and the greater part of the suspended fatty matter. The mixture having been allowed to stand on ice for twenty-four or forty-eight hours, it is filtered and the filtrate mixed with a further quantity of 95 per cent. alcohol, sufficient to precipitate all the sclerotic acid in combination with the bases (chiefly as calcium sclerotate). The separation of the precipitate is promoted as before by placing the mixture on ice for some days. This causes the deposited mass, which has a brownish colour, to adhere firmly to the walls of the vessel, so as to permit the supernatant liquid to be easily poured off. The precipitate is kneaded with alcohol of 80 per cent., and immediately thereafter dissolved in a sufficient quantity of 40 per cent. alcohol, when the remainder of the scleromucin and another larger portion of the foreign salts are left behind. The filtered liquid is now mixed with absolute alcohol, whereby sclerotic acid is precipitated in conjunction with certain bases and other substances. The impure product, when carefully dried over sulphuric acid, was found on analysis to contain 8·5 per cent. of potassium, about 0·36 per cent. calcium, 4·3 per cent. sodium, 2·74 per cent. phosphoric and 3·4 per cent. silicic acid; or altogether, 12·9 per cent. of ash.

The greater part of these admixtures may be removed and the sclerotic acid obtained free, by adding, before the final precipitation with absolute alcohol, a considerable quantity of hydrochloric acid (for every 100 c.c. of solution, 5–6 grams of the acid, sp. gr. 1·100), allowing to stand at ordinary temperature for a few hours, and then proceeding to precipitate. In this manner the amount of ash may be brought down to 3 per cent., and by repeated solution, addition of acid, and precipitation, it may further be reduced to less than 2 per cent. or 3 per cent. A more complete purification is difficult and hazardous, because every addition of hydrochloric acid causes the decomposition of a small quantity of the sclerotic acid, while at the same time a portion of the latter is lost by remaining in solution.

The resulting product, although not chemically pure, is nevertheless, so to say, physiologically pure, as it always produces constant and identical results, no matter from what sample of (good) ergot it was obtained.

Sclerotic acid is entirely odourless and tasteless. In aqueous solution it has a faint acid reaction, and decomposes calcium carbonate slowly, even on warming. Boiling nitric acid of 1·200 sp. gr. produces a little picric and oxalic acid, and a new substance, which assumes a bright yellow colour on adding ammonia or other alkalies. More concentrated nitric acid converts it into picric, oxalic, mucic, tartaric, and aposorbic acids. It is not a glucoside; nor does it lose its effectiveness, on the addition of dilute sulphuric or hydrochloric acids; on the contrary, the latter appears to intensify its effects. Boiling alcohol, in presence of sulphuric acid, extracts it from ergot in small quantities, cold alcohol not at all. It is therefore possible to abstract by means of cold alcohol and sulphuric acid a portion of the colouring matter from ergot, before extracting the sclerotic acid with water. But, unfortunately, the aqueous solutions (which carry with them a portion of the alcohol and sulphuric acid) spurt or bump so energetically during the distillation, that this modification of the process becomes unadvisable.

It might be supposed that sclerotic acid is not an acid, but an alkaloid, as it yields with phosphomolybdic acid a yellow, and with tannin an almost colourless, precipitate. But other alkaloidal precipitants are without action upon it, and only lead acetate with ammonia produces a strong flocculent precipitate.

When properly purified, sclerotic acid is hygroscopic but not deliquescent, which circumstance distinguishes it advantageously from the commercial purified extracts of ergot. It is found in these in greater or lesser quantity according as a weaker or a stronger alcohol was employed in exhausting the ergot. A few commercial extracts were found to be very deficient. In Bonjean's and Wernich's preparations and in Wigger's osmazom it exists in considerable quantity, while scleromucin is almost entirely absent, as is the case in all alcoholic extracts of ergot. In Zweiffel's preparation the acid occurs in a tolerably pure state, in a less pure condition in Buchheim's. In alcoholic tinctures of ergot, and in Wigger's ergotin, it is only present in traces or is entirely absent.

Good ergot contains about 4 to 4·5 per cent. of the acid, although samples are met with which contain scarcely 1·5 to 2 per cent.

The Alkaloids in Agaricus Muscarius. E. Harnack. (*Zeitschr. des oesterr. Apoth. Ver.*, from *Chem. Centralblatt*, vii., 560.) Koppe and Schmiedeberg have isolated from this fungus a poisonous alkaloid, to which they have given the name "muscarine."

The author has obtained a second alkaloid, which, however, is devoid of poisonous properties, by treating the aqueous extract of the fungus with water acidified with hydrochloric acid, evaporating to the point of crystallization, and pressing the crystalline mass thus obtained between filtering paper, which absorbs the very hygroscopic salt of muscarine, leaving the hydrochlorate of the second alkaloid.

The formula of muscarine is $C_5 H_{13} N O_2$, that of amanitine, the second alkaloid just referred to, $C_5 H_{13} N O$, which is the same as that of choline. Amanitine, however, is not identical with choline as by oxidation by chromic acid it does not yield betaine, but is partially converted into muscarine.

Chemistry of the Barks of the Oak, Willow, and Elm. E. Johansen. (*Journ. Chem. Soc.*, from *Archiv der Pharmacie* [3], ix., 210–248.) The investigation was undertaken with the view of ascertaining the nature of the different tannin-like substances contained in the barks of the oak, willow, and elm, and it was hoped, by isolating these and carefully examining their properties and the nature of their principal compounds, to ascertain whether they were analogous or even identical. By a long and elaborate process, the different tannins were separated from the three barks in something like a pure state.

Oak Tannin is a red-brown, amorphous, glistening body, easily soluble in alcohol, slightly soluble in ether, and forms an imperfectly clear solution in water. In its behaviour to litmus paper, metallic salts, and alkaloids, it is completely analogous to gallotannic acid. Dried at 110° it lost 8·48 per cent. of water. On analysis it gave 54·61 per cent. of carbon, 5·32 per cent. of hydrogen, and 40·07 per cent. of oxygen, agreeing approximately with Wagner's formula. $C_{14} H_{16} O_8$, which requires 53·85 per cent. of carbon and 5·13 per cent. of hydrogen. It contains also 0·77 per cent. of nitrogen and 0·13 per cent. of ash.

Willow Tannin consists of a brown-red amorphous body, with a slightly astringent taste; easily soluble in alchohol, slightly soluble in ether, and forming a thick solution with water. With ferric salts it gives a deep black colour, turned violet-red by alkalies. It precipitates murcuric nitrate and chloride, and zinc and copper sulphates, as well as albumen, starch, and alkaloids. At 120° the willow tannin lost 10·10 per cent. of water, and on analysis gave 51·13 per cent. of carbon, 4·78 per cent. of hydrogen, and 44·09 per cent. of oxygen. It contains also 1·88 per cent. of nitrogen and 1·63 per cent. of ash. Another specimen, prepared in a different manner, though possessing the same reactions as the last, contained 51·26 per cent. of carbon and 5·99 per cent. of hydrogen, besides having independently 0·44 per cent. of nitrogen and 1·42 per cent. of ash.

Elm Tannin.—In appearance and solubility this variety resembles oak tannin. With ferric chloride, it gives a dirty green precipitate, turned violet-red by sodium hydrate. With ferrous sulphate it gives a pure green precipitate. It precipitates lead and copper acetates, and zinc sulphate after some time. With zinc chloride, mercuric nitrate, calcium acetate, etc., it gave the usual reactions. At 110° elm tannin loses 3·32 per cent. of water, and, on analysis, gives 44·54 per cent. of carbon, 4·72 per cent. of hydrogen, and 50·71 per cent. of oxygen, besides containing 1·21 per cent. of ash.

The salts of these three tannin acids (quercitannic, salitannic, and ulmotannic) were next examined.

Lead Salts.—Quercitannate of lead is a chocolate-brown, amorphous mass, slightly soluble in water, insoluble in alcohol or ether. On heating it to 110° it lost 9·66 per cent. of water; and on analysis it gave 22·85 per cent. of carbon, 1·47 per cent. of hydrogen, 9·14 per cent. of oxygen, and 36·54 per cent. of lead oxide. The salitannate of lead resembled the last body, and on drying at 120° lost 4·50 per cent. of water, and on analysis gave 22·53 per cent. of carbon, 1·35 per cent. of hydrogen, and 53·28 per cent. of lead oxide. By fractionally precipitating with a lead salt, both these acids gave salts of varying constitution. Ulmotannate of lead was greyer than the last body, and on analysis gave 21·36 per cent. of carbon, 1·51 per cent. of hydrogen, 10·32 per cent. of oxygen, and 66·81 per cent. of lead oxide.

Copper Salts.—Quercitannate of copper is a brown substance, insoluble in alcohol and ether, and sparingly soluble in water. At 110° it lost 12·23 per cent. of moisture, and on analysis gave 39·99 per cent. of carbon, 2·38 per cent. of hydrogen, 28·14 per cent. of oxygen, and 29·49 per cent. of copper oxide. Salitannate of copper forms a dark reddish brown salt, which lost at 120° 12·4 per cent. of moisture, and on analysis gave 39·36 per cent. of carbon, 2·35 per cent. of hydrogen, 27·83 per cent. of oxygen, and 30·46 per cent. of copper oxide. Ulmotannate of copper is chocolate-brown, and after drying at 110° gave 39·68 per cent. of carbon, 1·93 per cent. of hydrogen, 17·98 per cent. of oxygen, and 40·41 per cent. of copper oxide.

Tin Salts.—Quercitannate of tin is a greenish brown substance, insoluble in alcohol and ether, and only sparingly soluble in water. At 110° it loses 5·98 per cent. of moisture, and on analysis gave 36·32 per cent. of carbon, 2·56 per cent. of hydrogen, 20·69 per cent. of oxygen, and 40·43 per cent. of stannous oxide. The formula $C_{30} H_{26} O_{13}$. 3 Sn O agrees fairly with these numbers. Salitannate of tin is a chocolate-coloured body, which loses 7·18 per cent. of moisture at 120°, and on analysis gives 35·17 per cent. of carbon, 2·79 per cent. of hydrogen, 15·05 per cent. of oxygen, and 46·50 per cent. of stannous oxide. Ulmotannate of tin on drying at 110° gave 38·99 per cent. of carbon, 2·40 per cent. of hydrogen, 13·66 per cent. of oxygen, and 44·95 per cent. of stannous oxide.

When these different tannins were acted on by dilute acids in the usual manner, as Grabowski has already shown, the oak tannin yields an easily decomposed saccharide and a crystalline body. The amount of these bodies obtained varies with the strength of acid employed. On purification the saccharide is obtained as a brown substance, forming a dark brown bitter syrup. Similar bodies were obtained from the willow tannin. On analysis the saccharide obtained from the willow tannin gave 36·94 per cent. of carbon, 5·19 per cent. of hydrogen, and 57·87 per cent. of oxygen. Elm tannin, on the contrary, yields no crystalline body, but only a saccharide resembling in every respect the last.

On fusing with potassium hydrate, the oak tannin yields, amongst other products, butyric acid amongst the volatile products, and protocatechuic acid from the residue. Willow tannin, similarly treated, yielded acetic and butyric acid amongst the volatile products, whilst the residue in the retort contained a body whose identity could not be satisfactorily made out. Elm tannin, treated in the same manner, yielded acetic and butyric acids among the volatile products, and oxyphenic acid in the residue.

Artificial Oil of Mustard. Dr. E. Mylius. (*Archiv der Pharm.*, [3], x., 207.) Some time ago Dr. Schacht stated at a meeting of Berlin pharmacists that owing to the identity of artificially prepared oil of black mustard with the genuine oil, the former might with perfect propriety be substituted for the latter in pharmacy. Having observed a decided difference in the odour of the two preparations, the author submitted a quantity of the best artificial oil he could obtain to fractional distillation, and a thorough chemical examination of the fractions. He found 1000 parts of the oil to contain—

Allyl Sulphocyanide	922	parts.
Carbon Bisulphide	8	,,
Hydrocyanic Acid	0·2	,,
Polysulphides (chiefly allyl trisulphide)	40	,,
Bodies not volatile without decomposition, containing both nitrogen and sulphur	30	,,

From these results the author draws the conclusion that until a satisfactory and inexpensive method of purifying the artificial oil of mustard, as met with in commerce, can be devised, this oil ought not to take the place of the genuine product in pharmacy. The oil examined by him was probably the unpurified product of the dry distillation of a mixture of allyl-sulphate and sulphocyanide of potassium. An oil prepared from iodide of allyl and sulphocyanide of potassium would be more expensive than the genuine article.

Determination of Potassium as Potassium Platinochloride in Presence of Chlorides of the Metals of the Alkaline Earths. Prof. R. Fresenius. (*Zeitschr. für Analyt.-Chem.*, xvi., 63–65; *Journ. Chem. Soc.*, 1877, 218.) This method, at the commencement, does not differ from that usually employed. The concentrated solution is treated in a small porcelain dish, with excess of pure platinum chloride in excess, evaporated on a water bath (below 100°) to a syrupy consistence, carefully mixed with alcohol of 80 per cent., and left a short time with frequent stirring. By this means the platino-potassium chloride, insoluble in alcohol, is separated from the sodium salt, which goes into solution.

At this stage the method begins to differ from the usual one. The alcoholic solution is poured through a small filter, and the residue in the dish treated with alcohol, till the potassium salt appears pure. This is then collected on the filter and washed thoroughly with alcohol of the same strength. The filter is then dried, to ensure the complete expulsion of the alcohol. If the quantity of the salt thus collected be large, it may be separated as much as possible from the filter-paper, from which the remaining salt is removed by boiling water; the solution is then evaporated to dryness in a small platinum dish. The main bulk is then added, the whole dried at 130°, and weighed. If the quantity is small, the precipitate may be wholly washed off the filter into the platinum dish, evaporated, and weighed as above.

To ascertain whether the weighed potassio-platinum salt is pure, treat it with repeated quantities of hot water, leave it to settle, and decant the solution into a dish. A little platinum chloride is then added, to convert any sodium chloride into the platinum-sodium salt, the solution evaporated as above almost to dryness, and mixed with alcohol of 80 per cent. The deposited potassium salt is filtered off and washed with alcohol, dried on the filter, and washed with boiling water in a platinum dish, into which the undissolved bulk of the original precipitate is brought. The whole is evaporated to dryness, dried at 130°, and weighed. Should any alteration in weight have taken place, the previous precipitate was impure, and the present weight may be regarded as the right one. Pure platino-potassium chloride must dissolve entirely in boiling water.

As regards the accuracy of the above method in presence of other alkaline salts, the following results are instructive. In a solution of potassium chloride, the potassium was determined as above, at first in the normal solution, then with addition of chlorides of barium, strontium, calcium, and magnesium respectively. The results show that the method maintains its accuracy in presence of the chlorides of any of the alkali-metals; but that when magnesium, barium, and strontium respectively are present, the results were very slightly in excess. To obtain perfectly accurate results the process recommended above should be strictly adhered to.

Note on the Volumetric Estimation of Phosphoric and Arsenic Acids by Uranium. G. Brügelmann. (*Pharm. Centralhalle*, 1877, 124, from *Zeitschr. für Analyt.-Chem.*) The author suggests the following modification of the uranium process generally employed:—The aqueous or acid solution of the phosphate or arseniate is mixed with a quantity of solution of sodium hydrate just sufficient to impart to the mixture a distinct alkaline reaction. Acetic acid is then added in excess, and the titration with uranium solution carried out in the usual manner, potassium ferrocyanide being used as an indicator. No addition of sodium or ammonium acetate is made before the titration. In this way only a very small quantity of alkaline acetate is contained in the mixture, and the smallest excess of uranium will be readily indicated by the ferrocyanide, whereas in the presence of larger quantities of acetate the sensitiveness of the reaction is considerably diminished, so as to necessitate the correction usually made in this titration. The author's process renders this correction superfluous.

Detection of Artificial Colouring Matters in Wine. A. Dupré. (*Analyst*, 1876, 26.) The colouring matter of pure red wine does not pass through the dialyser. The dialysate from pure wine is therefore colourless, or shows but a slight purplish coloration, such as water would assume on the addition of a small quantity of the the wine. A yellow or brownish yellow dialysate indicates an adulteration with logwood, brazil wood, or cochineal, the colouring matters of which may then be identified by the chemical and optical tests usually employed for this purpose. The ammoniacal solution of the colouring matter of cochineal yields three well-marked absorption bands.

Detection of Fuchsine in Wine. The following methods are recommended by E. Jacquemin in the *Comptes Rendus*, lxxxiii., 70:—

1. A small quantity of gun cotton is heated for a few minutes in 10–20 c.c. of the wine, and then washed with water. The nature of the coloration (if any) imparted to the cotton is now identified by means of solution of ammonia, which decolorises rosaniline but turns archil violet.

2. 100 c.c. of the wine are boiled to expel the alcohol, and then boiled for some time with white Berlin wool, previously moistened with water. The colour imparted to the wool by fuchsine is retained after washing, and may be distinguished from archil by ammonia.

3. 100–200 c.c. of the wine are boiled to expel the alcohol, then allowed to cool, mixed with ammonia in excess, and shaken with ether. By immersing white wool in the ethereal solution, and evaporating the latter, the wool acquires the characteristic colour of fuchsine.

C. Husson (*Ibid.*, 199) suggests the following mode of testing:—

Place a few c.c. of the wine in a phial and add ammonia, then immerse a piece of white Berlin wool in the mixture, withdraw it after it is well soaked, and pour upon it a drop of dilute acetic acid. In the presence of fuchsine the wool thus acquires a red tint.

Pure fuchsine is not very poisonous.

The method of estimating the arsenic which may have been introduced with the fuchsine into the wine, depends upon the fact that if arseniuretted hydrogen be passed into a solution of iodine in benzine, the colour of that solution is rapidly destroyed, whilst it is not affected by pure hydrogen.

It was found by experiment that 0·01 gram of arsenic in the form of arseniuretted hydrogen was decomposed by 0·02 gram of iodine. The process is to be practised as follows:—

Having decomposed the suspected matter by the ordinary processes, so as to obtain the arsenic as a potash-salt, this is dissolved in distilled water, and the solution divided into two parts: one is reserved for qualitative examination, the other divided into two. in one of which the arsenic is approximately determined by pouring it into a Marsh's apparatus which is evolving pure hydrogen, and passing the gas into a measured quantity of a standard solution of iodine in benzine, and as this is decolorised, gradually adding more from a burette until the decolorisation ceases. In the other part of the solution the quantity of arsenic is exactly determined by pouring it into a Marsh's apparatus as before, and allowing the evolved gas to pass through a series of about six test-tubes, each containing a known amount of iodine: for example, in the 1st 0·01 gram; 2nd and 3rd, 0·005 gram; 4th, 0·001 gram; 5th, 0·0005 gram; and 6th, 0·0001 gram; but these quantities may be varied according to the indications afforded by the previous experiment. By noting the number of test-tubes coloured, the exact quantity of arsenic introduced into the Marsh's apparatus can be ascertained.

The process recommended by L. Lamattena (*Ibid.*, 564) is as follows:—

Fuchsine may be detected by mixing 100 grams of the wine with 15 grams of coarsely powdered manganese dioxide, shaking for 12 or 15 minutes, and filtering through a double filter-paper. If the wine is pure it passes through colourless; if adulterated, some artificial colouring matter has been used. If pure peroxide is used, this process is unexceptionable; but if the manganese contains iron, the acids of the wine dissolve it, and it forms an insoluble lake with the colours which remain on the filter. If in this case the residue on the filter is treated with alcohol, the fuchsine dissolves, and may be immediately recognised by adding strong acetic acid and a few drops of ammonia.

Another process is described by E. Bouilhon (*Ibid.*, 858):—

500 c.c. of the wine are placed in a capsule, raised to a boil, and evaporated down to 125 c.c.; the capsule is then withdrawn from the fire, and 20 grams crystalline hydrate of baryta are added. The mixture is agitated to facilitate the reaction, allowed to cool, poured upon a filter, and the precipitate washed with distilled water, so as to obtain in all 125 c.c. of filtrate. It is then necessary to ascertain, by the addition of a few crystals of hydrate of baryta to the filtered liquid, that the precipitation of the colouring matter of the wine is complete; if not, more hydrate of baryta must be added, and the liquid re-filtered. It is then introduced into a flask containing about 250 c.c., with 50–60 c.c. of pure ether, strongly shaken, and allowed to settle. When the ether is completely separated from the aqueous liquids, it is drawn off by means of a pipette, and poured into a porcelain capsule. A drop of acetic acid at 8° is added, 3 or 4 drops of distilled water, and a little white unwoven silk, consisting of ten threads a centimetre in length. If the quan-

tity of magenta contained in the wine is at all notable, acetic acid produces at once a rose coloration; but when only minute traces are present, the ether is allowed entirely to evaporate. The residue consists of a small quantity of aqueous liquid, in which the silk soaks. The capsule is then very gently heated, so as to evaporate the bulk of this liquid and concentrate the traces of colouring matter in a few drops, thus favouring its fixation upon the silk. This process, if carefully executed, reveals one hundred-millionth part of fuchsine in wine.

The following directions are given by G. M. Fordos (*Ibid.*, 980):

10 c.c. of the wine are shaken with 1 c.c. of pure ammonia, 5 to 10 c.c. of chloroform are then added, the whole well shaken, and the chloroform, after separation by a tap-funnel, heated in a porcelain dish with a piece of white silk immersed in it; when the chloroform is nearly evaporated, a little water is added, and the heating continued. All the fuchsine is thus fixed in the silk, which becomes more or less rose coloured if fuchsine is present.

This method permits of the detection of extremely small quantities of fuchsine, especially if the wine be concentrated, and a very small piece of silk be used. Quantitative results might be obtained by means of a series of pieces of silk coloured more or less deeply, with which the piece coloured by the wine under examination might be compared.

On page 1045 of the same journal a modification of this process is described by J. Fordos:—

To 10 c.c. of the wine to be tested for fuchsine 1 c.c. of ammonia and 10 c.c. of chloroform are added. The test-tube is to be several times inverted, but not shaken, and the chloroform drawn off by means of a tap-funnel; a little water is added to it, and then it is saturated with acetic acid. The fuchsine now separates from the chloroform, and its aqueous solution floats on that liquid. Another modification is to use only 5 c.c. of chloroform, and when this has settled to the bottom of the tube, to drop in a crystal of citric acid. The ammonia being saturated, the fuchsine appears on the crystal.

New Researches on Gallium. Lecoq de Boisbaudran. (*Journ. Chem. Soc.*, from *Comptes Rendus*, lxxxii., 1076.) Pure gallium melts at 29·5° and liquefies on being held between the fingers. It remains in a state of superfusion with great facility, which explains how a globule of it may remain liquid for several weeks, even though the temperature may occasionally fall nearly to zero. When solidified the metal is somewhat hard, even at a temperature only a few degrees short of its fusing point; it possesses, however, some malleability, and may be cut with a knife. When melted it adheres to glass, forming a mirror which is whiter than that produced by mercury. Heated to redness in air gallium oxidises only superficially, and does not volatilise. Hot nitric acid dissolves it, but the cold acid scarcely attacks it. The density of the metal is 4·7 at 15°, determined as nearly as possible on 0·064 gram weight of it.

The metal was obtained by electrolysing an ammoniacal solution of gallium sulphate; its hydrochloric acid solution gave the spectroscopic lines of gallium, and much more feebly those of zinc.

The oxide of gallium is very soluble in potash, but only slightly so in ammonia; but the metal deposited from the latter is solid, and from the former it is liquid.

The metal is deposited upon the platinum negative electrode in minute globules, from which dilute hydrochloric acid dissolves it with rapid liberation of hydrogen. The hydrochloric solution was not coloured by potassium iodide, ammonia, or ammonium sulphide.

Chemical Reactions of Gallium. Lecoq de Boisbaudran. (*Chem. News*, October, 1876.) Solutions of *pure* gallium, mixed with acid acetate of ammonia, are not rendered turbid by sulphuretted hydrogen; but if zinc is present the sulphide of this metal is charged with gallium, but the liquid is not entirely freed from it. If the salts of zinc are not plentiful enough to draw down at once all the gallium precipitable by sulphuretted hydrogen, it must be added in small portions until these products no longer give the ray Ga *α* 417·0 in the spectroscope. Only slight traces of gallium remain then in the liquid. On proceeding thus, the amount in the precipitates appears to remain at first almost constant, or at least to decrease slowly, and then more and more rapidly, thus leaving but a small trace of gallium in the liquid These observations point to a combination between the two substances, or perhaps more probably to a surface-attraction analogous to the fixation of a colouring matter upon a mordant. It is known that salts of zinc slightly acid are precipitated by sulphuretted hydrogen, the action being limited by the quantity of strong acid set at liberty. If the experiment is made with a chloride of zinc containing gallium, a notable quantity of this metal falls along with the sulphide of zinc. An ammoniacal solution of the salts of gallium and zinc is precipitated by hydrosulphate of ammonia. An excess of the reagent does not remove the gallium, unless, indeed, the sulphide of zinc is in such small quantity as to dissolve also. The case is different when the salt of gallium is pure. The ammoniacal solution is not rendered turbid by the sulphide of ammonium. If a neutral or slightly acid solution of the chlorides of zinc and gallium is submitted to fractionated precipitation with sulphide of ammonium containing free ammonia, the gallium is concentrated in the first products. If an ammoniacal solution of zinc and gallium is submitted to the same treatment, the gallium, on the contrary, accumulates in the last precipitates

A New Process for the Extraction of Gallium. Lecoq de Boisbaudran. (*Comptes Rendus*, lxxxiii., 636.) The gelatinous precipitate obtained by treating acid solutions of the gallium-bearing mineral with excess of zinc, is dissolved in hydrochloric acid; sulphuretted hydrogen is passed through the liquid; and after the gas has been expelled from the filtrate, the latter is fractionally precipitated by sodium carbonate, until gallium ceases to be thrown down, and the precipitate no longer yields the characteristic spectrum of the metal. The precipitates are dissolved in sulphuric acid, and the solution is evaporated until vapours of sulphuric acid cease to be evolved. The residue is treated with cold water, and after dilution the solution is heated to boiling, when a sub-salt of gallium is precipitated and separated by filtering while the liquid is hot. This basic salt is dissolved in a small quantity of sulphuric acid, a slight excess of caustic potash is added, and the filtrate is treated for some time with a current of carbonic acid gas, by which gallium oxide is precipitated. This is dissolved in the smallest possible quantity of sulphuric acid, a small excess of slightly acid ammonium acetate is added, and sulphuretted hydrogen is passed through the liquid, which is then filtered, diluted, and heated to boiling. The greater part of the gallium is now precipitated, and is separated by filtering the hot liquid. The precipitate is dissolved in sulphuric acid, caustic potash is added in slight excess, and the solution is filtered and submitted to electrolysis. The metallic gallium is easily separated from the platinum pole by pressing with the fingers under warm water, and the product is purified by treatment with nitric acid free from chlorine.

The Physical Properties of Gallium. Lecoq de Boisbaudran. (*Comptes Rendus*, lxxxiii., 611.) The author has prepared more than half a gram of gallium; when liquid it has a silver-white lustre, but when crystallized it shows a tinge of blue and loses its brilliancy. Its crystalline form is octohedral. Its melting point, averaged from six determinations, is 30·15°. It is hardly acted on by nitric acid diluted with its own volume of water. Its specific gravity is 5·956; when crystallized under water, it decrepitates slightly when melted.

MATERIA MEDICA.

PART II.

MATERIA MEDICA.

Wood Oil. Prof. F. A. Flückiger. (*Pharm. Journ.*, 3rd series, vii., 2). In a note communicated to the *Archiv der Pharmacie*, for May, the author states that he has found that the ethereal oil of dipterocarpus balsam, known as gurgun balsam, or wood oil, when dissolved in about 20 parts carbon bisulphide, and a drop of a cooled mixture of equal parts of sulphuric and nitric acids added, takes a splendid violet colour. A single drop of the ethereal oil is sufficient to produce the reaction, and the colour lasts several hours. It is not prevented by the presence of resin or by copaiva balsam; so that the reaction takes place with the crude gurgun balsam, or even when that is mixed with eight times its volume of copaiva balsam. The reaction can therefore be used to detect the presence of gurgun balsam in copaiva balsam. Under the same conditions, fish liver oil and oil of valerian are also coloured a beautiful violet; but only transiently so. In order to exclude fish oil from the test, it is recommended to distil off the ethereal oil; although, on account of its high boiling point (250° to 260° C.), this is not an agreeable task. Only a few drops are required, however, for the test.

Should a wood oil not correspond to this reaction, the author thinks it might probably be due to the fact that some dipterocarpus trees yield a varying balsam. The balsam is obtained in large quantities from the following species:—*Dipterocarpus turbinatus*, Gaertn. (syn. *D. lævis*, Ham.; *D. indicus*, Bedd.), *D. incanus*, Roxb.; *D. zeylanicus*, Thw.; *D. trinervis*, Blume; *D. littoralis*, Bl.; *D. alatus*, Roxb.; *D. hespidus*, Thw.; *D. gracilis*, Bl.; *D. retusus*, Bl. All these species occur in India, and in the Archipelago, and the last even in the Philippines. Their resinous juice is used very generally as varnish, hence the name "wood oil." It is hardly probable that they all yield a resin chemically and physically identical. The author has found that the oil distilled by him from undoubtedly true dipterocarpus balsam is dextrogyre; whilst Werner, who first examined gurgun balsam in 1862, speaks of it as lævogyre. In all the specimens examined by the author to the present time, however, he has found the colour reaction constant.

Another possible ground for failure in obtaining the reaction is its confusion with other liquids used for similar purposes. The balsam obtained from *Hardwickia pinnata*, Roxb., a leguminaceous plant, is used in Southern India in the same medical cases as copaiva balsam; but an authentic specimen in the author's possession is not fluorescent like dipterocarpus balsam, and dissolved in carbon bisulphide gives only a yellow colour with the acid mixture. The author does not know, however, that it is ever there called "wood oil."

A fat oil used in enormous quantities in Eastern Asia for paint and varnish, and also as a drastic medicine, and very generally called "wood oil," is obtained from the seeds of *Aleurites cordata*, Muller (syn. *Dryandra cordata*, Thunb.; *Elaeococca Vernicia*, Sprgl.; *E. verrucosa*, A. Juss), a euphorbiaceous tree. The tree is common in China and Japan, of very characteristic appearance, and is known in China as the "tung tree." The oils from the seeds of *Ricinus* and *Croton tiglium* differ in chemical properties and physiological action from most known oils; how far such peculiarities occur principally in the *Euphorbiaceæ*, is a question that yet requires answering. That the "wood oil" from the tung tree is a fat worthy of notice is shown by the experiments of Cloez. This chemist obtained from the seeds of *Aleurites cordata*, by means of carbon bisulphide, 41 per cent. of a fixed oil, forming a solid crystalline mass below 32° C. When, on the contrary, the seeds were treated with ether, an oil was obtained that did not solidify even at 18° C. But what is most surprising, is that when prepared either by pressure or by one of the solvents mentioned, and heated in the air to 200° C., it changes suddenly into a solid transparent jelly, which is no longer soluble in ether or carbon bisulphide. This change takes place also after a few days, when excluded from the air, under the influence of light alone. The oil dries more rapidly than linseed oil. The principal acid in it was obtained in crystals that melted at 44°, but very rapidly resinified, and therefore did not consist of linoleic acid.

The Therapeutic Properties of Arnica. Dr. Patze. (*New Remedies*, July, 1876.) Strong opinions having been expressed by various writers that the external application of arnica is not only valueless but sometimes positively noxious, and that arnica lotion applied to excoriations may occasion severe outbreaks of acute inflammation, the author offers the following remarks on the subject:—

Experiments with arnica on horses have, according to Schuchardt, rendered the following results: small doses accelerated the pulse, raised the temperature of the skin, increased the secretion of urine, and caused tremor of the muscles. The violence of these phenomena increased with the augmentation of the dose, causing frequent evacuations of fæces and urine, violent tremor, accelerated respiration, and prostration. Injections of an infusion of arnica-flowers into the veins caused considerable excitation, soon followed by intense languidness, vertigo, and even death ; and on examination, the organs of the chest and abdomen, the cerebrum and spine, were found engorged with blood.

In man the series of symptoms are the following : any part of the arnica-plant applied to the skin causes an itching, burning sensation, accompanied by redness ; though its fragrance is agreeable, it will, in closer proximity, cause sneezing, so much so, that the Savoyards are using it instead of snuff. Small doses of 4 to 10 grains exert an irritating effect on the fauces and larynx, on the stomach and the alimentary canal, manifesting itself by a burning, scratching sensation, cardialgia, abdominal pains, nausea, belching, vomiting, frequent evacuations, the circulation is accelerated, accompanied by increase of warmth of the body ; the secretions are increased, especially those of the urine, the skin, and the lungs. The continued use of the arnica will cause numbness of the head, vertigo, mental depression, restless sleep, oppression of the lungs, jerking pains like electric strokes, in the extremities, etc. ; increase of the dose will aggravate all these phenomena, especially the affections of the brain.

The hot infusion acts more severely than the tincture, and the flowers are more exciting than the root. This series of symptoms indicates that arnica may find its place in all those diseases which manifest a character of torpor, wherever an acceleration of the circulation is desirable, in order to remove and scatter stagnating humours.

Arnica is in Germany so extensively and frequently used, that some apothecaries have to keep the infusion, by the quart, on hand, preparing it every morning fresh (ʒ j. of the flowers steeped for 15 minutes in 6 ounces of boiling water). It has maintained its old reputation in a variety of cases, especially where the vitality of the nerve-centres, brain and spine, is oppressed ; in extravasations, paralysis consequent upon apoplectic strokes, rheumatism, catarrh, pleurisy and pneumonia, in traumatic commotions of the brain, in typhoid fevers with torpor and paralytic affections, etc.

The external use of arnica is very limited, and especially contraindicated in recent traumatic cases ; it should never be applied before all tendency to inflammation is removed by the antiphlogistic applications; it can therefore seldom find its place before the lapse of seven days after the injury; then, and not before then, the tincture, properly diluted in combination with other remedies for the stimulation of the capillary vessels, may be applied, perhaps like this:—℞ Tincturæ flor. Arnicæ, ℥ ss; Aceti, ʒ ss; Aq. Camphoræ, ℥ vj. d. g. for external use.

Olive-tree Bark. L. Thibon. (*Répert. de Pharm.*, 1876, 558.) This bark, which is favourably spoken of as a febrifuge, contains a principle which the author has named oliverine. It is prepared by evaporating an aqueous decoction of the bark to the consistence of a syrup, precipitating by strong alcohol, filtering, and precipitating the filtrate by oxalic acid. The filtrate from the last precipitate deposits the oliverine during evaporation. When purified it forms yellow granules having a very bitter taste. Dr. Fabry has administered the substance in doses of 0·1 to 0·3 gram four or five times a day, and speaks highly of its effects. It is recommended in cases where quinine is indicated.

Coto Bark and its Crystallizable Constituents. J. Jobst. (From *Ber. der deutsch. Chem.-Ges.*, ix., 633; *Pharm. Journ.*, 3rd series, vii., 495). The author reports that the crystallizable body some months since separated by him from Bolivian coto bark, and named by him "cotoin," has since, on account of its excellent anti-diarrhœic action, been used to a considerable extent; but unfortunately the importation of the crude material has not kept pace with the demand. After a long interval a larger parcel of coto bark came into his possession; but the new bark showed marked differences in its exterior, which were also manifest in the taste and smell. Upon the extraction of the bark by the process given for cotoin, a body similar to cotoin, crystallizing in yellow flakes, was obtained, which, however, was not cotoin, and differed from it essentially in its reactions.

In the first place, the new body wants the biting taste of cotoin; further, it is much more difficultly soluble in water, alcohol, ether, ammonia, and potash solution. Concentrated sulphuric acid does not give with it the characteristic reaction of cotoin, but only a yellow solution; lead acetate causes no precipitate.

The author proposes for this substance the name of "paracotoin," and states that in the last imported coto bark several other crystallizable bodies are contained in smaller quantities.

Upon making complaint respecting the varying quality of the bark, the author was told that the parcel in question came from the banks of the river Mapiri, in Bolivia, and represented the best coto that it furnished. No further information could be obtained.

The author's stock of cotoin, prepared from the original coto bark, being almost exhausted, he was induced by the undoubted similarity of the two barks and their principal products, to seek to ascertain the therapeutic action of the new body. The experiment was made by Herr Burkart. He found that paracotoin exercises the same anti-diarrhœic action as cotoin, the difference between the two preparations being only of one degree; paracotoin, in accordance with its inferior solubility, showing a somewhat weaker action than cotoin, consequently the dose slightly varies. In his therapeutic experiments, Herr Burkart administered it either in the powder form, 0·1 gram with 0·2 grams of saccharum album every three hours, or in emulsion, 0·5 gram. On account of its insolubility, the powder form, in the above doses, was preferred; the patients taking the powder more readily on account of its complete tastelessness.

A relation appears, therefore, to exist between the two coto barks similar to that observed in the case of the cinchonas; where barks have been found within narrow limits in which alternately quinine or cinchonidine or cinchonine predominate.

The author is engaged in an investigation of the relation in which cotoin, paracotoin, and the other crystalline constituents of the coto bark, stand to each other in respect to their chemical composition.

The Constituents of Coto Bark. J. Jobst and O. Hesse. (*Ber. der deutsch. Chem.-Ges.*, x., 249, from *Pharm. Journ.*, 3rd series, vii., 1019.) This bark has been further examined by the authors, and the results have been communicated to the Berlin Chemical Society. The powdered bark extracted with ether yielded a yellow-brown solution, which left, after evaporation of the ether, a brown resinous residue that showed after a time an abundant crystallization. The crystalline mass consisted principally of three bodies, to which the authors have given the names "paracotoin," "oxyleucotoin," and "leucotoin;" these were separated by fractional crystallization from hot alcohol.

Paracotoin ($C_{19}A_{12}O_6$) forms yellow scales, easily soluble in chloroform, ether, and boiling alcohol; less soluble in cold alcohol, benzin, petroleum spirit, and boiling water. From the solution in boiling water it is obtained on cooling in almost colourless scales. In alcoholic solution it has no reaction on litmus paper, and is tasteless. In ammonia it is insoluble; and from hot ammoniacal alcoholic solution it crystallizes unaltered. In dilute potash or soda it dissolves with a yellow colour, but only in small proportion. In strong sulphuric acid it forms a yellow solution, but this upon heating becomes lighter. Perchloride of iron presents no reaction with it. Paracotoin melts at 152° (uncorrected) to a yellow liquid, which upon cooling takes a radiating crystallization. At a higher temperature it sublimes in yellow shining scales.

By the action of baryta water paracotoin is converted into paracotoic acid, according to the equation,—

$$C_{19}H_{12}O_6 + H_2O = C_{19}H_{14}O_7.$$

This acid forms a chrome yellow amorphous powder, readily soluble in ether and alcohol, but almost insoluble in hot benzin. The alcoholic solution has a decided acid reaction, and upon evaporation leaves the acid amorphous. The same acid is formed when paracotoin is boiled with dilute potash solution, or only heated to 80° C.; but then there is also formed a smaller quantity of another product, which has been named "paracumarhydrin." When the solution is boiled it escapes with the steam. Paracumarhydrin, $C_9H_8O_3$, forms delicate white scales, melting at 85° C. (uncorrected), readily soluble in alcohol and ether, less so in hot water, from which upon cooling it is again deposited in scales. Its formation from paracotoin may probably be represented as follows:—

$$C_{19}H_{12}O_6 + 2H_2O = CO_2 + 2C_9H_8O_3.$$

Paracumarhydrin has a smell recalling that of cumarin; and when it is rapidly heated the odours of oil of winter-green and oil of bitter almonds are noticeable. Upon attempting to redistil it with water vapour only a small portion passes over, the greater part remaining dissolved in the water in the retort. Upon shaking this aqueous solution with ether, and evaporating the latter, white crystalline scales are obtained, having an extremely pleasant taste, and melting at 81° to 82° C. The same substance results upon treating paracumarhydrin with zinc chloride. Apparently in both cases it loses water and forms the paracumarin corresponding to paraoxybenzoic acid.

Comparison of this substance with cumarin shows that it resembles it only in smell. Whilst cumarin is deposited from dilute alcohol in four-sided prisms, the supposed paracumarin forms shining scales. The fusing points also differ. Zwenger and Bodenbender found that for cumarin prepared from *Melilotus officinalis*, it was 67°; and Perkins, for that from aceto-salicyl aldehyd between 67° and 67·5° C. By treatment of paracotoin with caustic potash, an acid was obtained crystallizing in small needles, and melting at 200°, or nearly the temperature given by Tiemann and Mendelsohn for paracumaric acid. The crystals, however, were yellow, and gave on combustion only 60·91 per cent. of carbon, and 4·05 of hydrogen; paracumaric acid requiring 65·88 per cent. of carbon, and 4·87 per cent. of hydrogen. When fused with potassium hydrate, paracotoin gave off a faint smell of paracumarhydrin; but an acid was formed, with evolution of hydrogen, corresponding with protocatechuic acid in its behaviour towards ferric chloride, though differing in other respects. A volatile acid (apparently formic acid) was also formed, and a brown resinic acid.

Oxyleucotoin ($C_{21} H_{20} O_7$) can be separated from leucotoin by crystallization from alcohol, in which the latter is very soluble. It forms thick, heavy, white, rectangular, obliquely truncated prisms, melting at 133°, and solidifying amorphous on cooling. It dissolves freely in hot alcohol, ether, and chloroform; less so in cold alcohol, and is nearly insoluble in cold water and alkalies. It is tasteless, and neutral, and in chloroform solution does not affect polarized light. Strong sulphuric acid colours it dark yellow. Strong nitric acid dissolves it upon warming with a blue-green colour, leaving a bluish black resin that forms a blue-green solution in alcohol. When fused with potassium hydrate, oxyleucotoin yields a crystallizable acid, giving a green colour with salts of iron, and also differing from pyrocatechuic acid.

Leucotoin ($C_{21} H_{20} O_6$) resembles oxyleucotoin in its behaviour to sulphuric and nitric acids; dissolves very freely in alcohol, benzin, and ether; forms very slender white prisms melting at 97°. In chloroform solution it has no action on polarized light. It occurred in considerable quantity in the bark examined.

Hydrocotoin ($C_{22} H_{20} O_6$) remained dissolved in the mother-liquor from which the foregoing substances were obtained. This liquor, being evaporated, left a brown resin, which was exhausted with very dilute caustic alkali, excess of hydrochloric acid added to the solution, and the resulting reddish yellow flocculent precipitate dissolved in a little hot alcohol, from which the hydrocotoin crystallized on cooling in shining pale yellow prisms. From boiling water slender white needles were obtained. Hydrocotoin is neutral, tasteless, and in chloroform solution without effect on polarized light. It dissolves in alkalies with a yellow colour; and is again precipitated by acids, even carbonic. Strong sulphuric acid forms with it a yellow, and hot nitric acid a purple red solution; from which, upon dilution with water, a purple red precipitate soluble in cold alcohol separates. When heated with manganese and sulphuric acid, or upon combustion of one of its lead salts, hydrocotoin, gives off an odour resembling hyacinthin.

Cotoin, the substance obtained from the coto bark first examined, the authors now represent by the formula, $C_{22} H_{18} O_6$; so that paracotoin would appear to be a homologue differing by $C_3 H_6$. Hydrocotoin appears to differ from cotoin in containing two atoms more of hydrogen in the molecule.

The authors state that Dr. Burkart, of Stuttgart, is making experiments with paracotoin, oxyleucotoin, and leucotoin; the results of which will be reported in a medical periodical. Meanwhile, paracotoin, notwithstanding its high price, which is probably temporary, is finding a daily use as a remedy against all kinds of diarrhœa.

Adonis Vernalis. F. Linderos. (*Liebig's Annalen*, 182, 365.) The dried leaves of this plant are employed on the Continent as a drastic purgative. According to the author's investigation, the leaves gathered at the time of flowering contain, when dry, 10 per cent. of aconitic acid, which appears to be combined with calcium and potassium.

The Chemical Constituents of Angelica Root. C. Brunner. (*Neues Repert.*, xxiv., 641; *Journ. Chem. Soc.*, 1876, 939.) The following analysis of angelica root was given, many years ago, by Johw:—300 parts contain: colourless volatile oil of a penetrating odour, 2 parts; resin, with sour taste, 20; other extractives, 37·5; gum, 100·5; inulin, 12; product soluble in caustic alkali, probably combined with albumen, 22; woody tissue, with a trace of matter soluble in potash, 90; water, 16 parts. Similar figures were also obtained by Buchholz and Brandes, who found six per cent. of "angelica balsam." This product was afterwards found by A. Buchner to contain an agreeably smelling, camphoraceous, essential oil, a volatile acid, a waxy substance, an amorphous resin, and a crystallizable principle analogous to imperatorin and peucedanin, to which he applied the term *angelicin*. The author prepared this substance from fifty pounds of root grown near Schweinfurt. After complete extraction with boiling alcohol, and evaporation of the extract, 1090 grams of "balsam" separated, insoluble in water; whilst an aqueous liquid was also obtained, in which the balsam floated. This liquid was found to contain *cane sugar*, the values 73·2 and 73·04 being obtained by the polariscope; whilst the specific rotatory power given in text-books is 73·84.

The "balsam" thus obtained was heated with aqueous caustic potash (500 grams balsam, 180 of solid caustic potash) until a homogeneous, brownish red, thick fluid was obtained; on distillation this furnished a small quantity of an ethereal oil. When this ceased coming over, the residue was evaporated to a thick syrup, and dissolved in water. After standing all night, and filtering, a minute quantity of insoluble matter was obtained, possibly *angelica wax*.

The liquid did not deposit crystals of angelicin on standing; it was therefore again evaporated, and the residue treated with alcohol, whereby much resin was left undissolved; the filtrate was saturated with carbonic acid, to remove potash; and the filtrate from the crystals of potassium carbonate evaporated to a small bulk, and then treated with ether as long as the latter became coloured. By spontaneous evaporation the ethereal extract gave a smeary residue, containing a few crystals; this residue became much more crystalline on stirring it up with alcohol, and again leaving it to evaporate spontaneously. Finally, the mother-liquors were removed by the filter pump, and washing with 80 per cent. spirit. The crystals of angelicin thus obtained weighed, after purification by recrystallization, only about 0·8 gram. This small yield appeared to be due to the fact that the roots employed had been dried in an oven; from thirty pounds of air-dried roots a much larger yield was obtained by the same process. Finally, about 4 grams of pure angelicin were isolated, constituting fine white silky plates, destitute of taste and odour; slightly soluble in cold, more so in hot, alcohol; and readily soluble in ether, choloroform, carbon disulphide, benzin, oil of turpentine, and warm olive oil. On analysis this substance gave numbers agreeing with the formula $C_{18}H_{30}O$. From these figures, and the general properties of the substance, it appears to be identical with the *hydrocarotin* of Husemann. It melts at 126·5° to yellowish oily drops, which solidify at 118° to an amorphous mass, soluble in alcohol and ether, but not crystallizing from these solutions (the original substance crystallizes readily in forms belonging to the monoclinic system). Concentrated hydrochloric acid does not change angelicin; but fuming nitric acid dissolves it with evolution of gas. Concentrated sulphuric acid dissolves it to a red fluid, depositing brownish white flakes on dilution with water. Fusion with caustic potash, and treatment with bromine, give rise to the formation of amorphous coloured products.

The resin insoluble in alcohol, obtained as above described, was fused with caustic potash in a silver dish; the product, dissolved in water and acidulated with sulphuric acid, evolved acetic, butyric, and other fatty acids; and the aqueous liquid yielded to ether a mixture of two substances, separable by addition of lead acetate. The precipitate thus thrown down gave, after decomposition by sulphuretted hydrogen, a small quantity of a crystalline acid, colouring ferric chloride green, the coloration becoming deep red on further addition of sodium carbonate. With silver nitrate this gave no precipitate; but on further addition of ammonia immediate reduction ensued. Hence this product was doubtless *protocatechuic acid*.

The filtrate from the lead precipitate was treated with sulphuretted hydrogen, and evaporated, whereby crystals were obtained consisting apparently of *resorcin;* they sublimed between watch-glasses, coloured ferric chloride violet, reduced silver nitrate on warming, gave a highly fluorescent product on treating with phthalic acid and sulphuric acid (Baeyer's test), and formed a body which—like *diazoresorcin*—was red, and became blue on adding ammonia, on treating the ethereal solution with nitric acid containing nitrous acid (Weselsky's test).

The liquid from which angelicin was dissolved out by ether, as above described, contained the potash salt of a volatile acid, which appeared to be *angelic acid.* This was obtained by adding sulphuric acid and distilling; oily drops insoluble in water thus came over, and on collecting these and placing them in a freezing mixture, crystals separated, which were drained and pressed in filter paper, and these possessed all the properties of angelic acid. Valerianic and acetic acids came over, together with the angelic acid, on the first distillation.

Some Constituents of Cubebs. E. Schmidt. (*Ber. der deutsch. Chem.-Ges.*, 1877, 188.) The author's statement that the stearopten of oil of cubebs is a hydrate of the oil corresponding to the formula $C_{15}H_{26}O = C_{15}H_{24} + H_2O$, has been called in question by J. Jobst and O. Hesse, who regard this body as an oxidation product of the oil, the composition of which is represented by the formula $C_{15}H_{24}O$.

The author has therefore resumed his investigation of this subject, and has obtained results completely confirming his previous statements.

Cubeb-camphor fuses at 65° C., and gives off water when heated in a sealed tube to 200° C. When kept over sulphuric acid under a bell jar, it also parts with water, and is converted into a transparent oily liquid having the same boiling point as oil of cubebs (250°–260°). Repeated analyses of the camphor yielded numbers establishing the correctness of the formula $C_{15}H_{24} + H_2O$.

Cubebin, which the author formerly described as a crystallizable resin of the formula $C_{33}H_{34}O_{10}$, has also been re-examined, and is now regarded by him as an oxidation product of the oil, answering to the formula $C_{30}H_{30}O_9$, which agrees with the formula found by Heldt.

An Adulteration of Aconite Root. E. M. Holmes. (*Pharm. Journ.*, 3rd series, vii., 749.) Aconite root possesses such powerful properties, that it is very important the medicinal article should be, as far as possible, of uniform strength and quality. Yet this is by no means the case, for it is difficult to find in a commercial sample one root in a dozen which upon fracture appears sound and in good condition. This is due, according to Hanbury, to its being gathered indiscriminately by peasants, who regard neither the most advantageous time for collection, nor the proper species. From the cheapness of the root, and from the fact that few roots have the distinctly conical appearance of aconite, it is evident that it would scarcely pay to adulterate it. Adulteration then must either result from careless collection, or from accidental admixture.

The root which has lately been found mixed with aconite is that of masterwort, *Imperatoria ostruthium*, L., an umbelliferous plant, official in the Edinburgh Pharmacopœia so late as 1792. It is a native of mountainous countries, and grows in similar districts to those in which aconite is found. As it is still official in the German Pharmacopœia, its accidental occurrence in aconite root from Germany is not surprising.

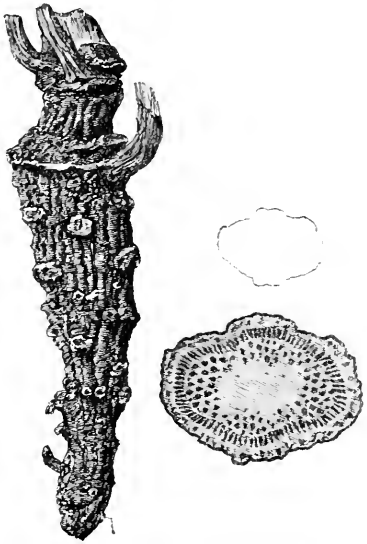


Fig. 1. IMPERATORIA OSTRUTHIUM.*

Its value in this country is double that of aconite root, and it is obvious therefore that it has not been purposely used as an adulteration.

In the sample examined, the masterwort root amounted to about 5 per cent.

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* The woodcuts of this and subsequent illustrations were kindly lent by the Editor of the *Pharmaceutical Journal.*

The characters by which it may be distinguished from aconite root are as follows:—

The root-stock (Fig. 1), for it is properly so called, is less tapering than aconite root, is slightly compressed, and exhibits several warty zones, indicating periods of growth. The whole of the root-stock is finely wrinkled transversely, so as to give it a somewhat annulated appearance. The transverse section presents very marked characters. The central portion is of a yellowish white colour, and exhibits a more or less complete ring of brownish dots. The portion next the bark presents elongated dots of a paler colour, which give this portion of the section a radiate appearance. With the aid of a lens, these dots are seen to be filled with an oily or resinous substance. The cortical portion is very thin. The root-stock has an odour comparable to bruised ivy leaves, or to the plant commonly known as cow parsley (*Chærophyllum sylvestre*, L.), and a pungent slightly bitter taste.

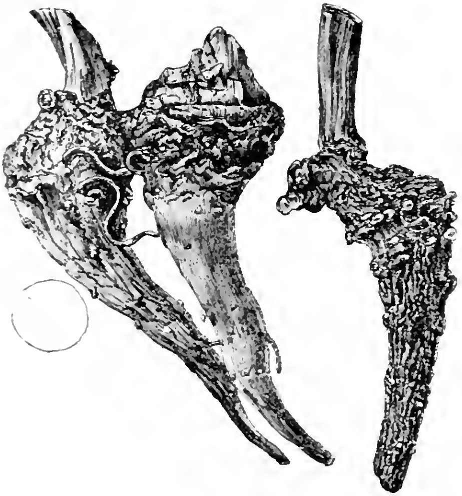


Fig. 2. ACONITUM NAPELLUS, L.

Aconite root is very variable in appearance internally; frequently the centre is quite hollow. Some pieces have a brownish colour, others are white and starchy, and a few present a resinous fracture. In a sound root, however, which is usually starchy or slightly resinous, a faint line may generally be traced, which marks out the meditullium. This line has usually five to nine prominent angles (*see* Fig. 2), the number of angles being larger as the section approaches the top of the root. If the root be wetted and examined with a lens, the line is seen to consist of an irregular line of vessels, which form small bundles in the apex of the projecting angles. The cortical portion occupies nearly half of the circumference of the root.

From the above characters it will be observed that the presence of oil receptacles in the masterwort root at once distinguishes it from aconite. A spirituous tincture of masterwort when dropped into water gives a blue fluorescence resembling that of quinine, and a slight milkiness, and communicates to the water its peculiar odour. By these characters its presence might probably be detected in a mixture containing tincture of aconite. Although the small percentage in the sample examined would lead to but very slight diminution of strength in the tincture of aconite made from it, yet the appearance and odour communicated to a mixture containing such a tincture, might lead to much inconvenience in pharmacy, and throw discredit upon the dispensing department.

It is quite time that the attention of cultivators of medicinal plants in this country should be drawn to the bad quality of the imported root, and that attempts should be made to cultivate it extensively in this country. It is very probable that, as in the case of henbane, a good article would command a fairly remunerative price. It is obvious, also, that until it is possible to obtain a plentiful supply of the roots of *Aconitum Napellus*, free from any admixture of other species, it will not be possible to obtain an accurate knowledge of the alkaloids contained in that species.

Kosin. Prof. Buchheim. (*Repertor der Pharm.*, xxv., 423.) The author's previously published observations on the comparative merits of Merck's crystallized kosin and Bedall's koussin have led Prof. Flückiger to the conclusion that the anthelmintic action of the first named preparation is much inferior to that of the latter (see *Year-Book of Pharmacy*, 1875, pp. 19–22). Prof. Buchheim now states that he does not agree with this conclusion. He considers kosin as better suited for medicinal administration than koussin, and as quite equal to it in its anthelmintic properties. Bedall's koussin appears to be kosin which has undergone a partial change through the energetic action of the lime employed in its preparation.

Admixture of White Hellebore with Valerian Root. Prof. Bentley. (*Pharm. Journ.*, 3rd series, vii., 649.) Having recently detected the rhizome and rootlets of *Veratrum album* in a parcel of valerian, the author calls attention to the principal distinctive characters between the two drugs as exhibited in the specimen examined by him.

In the first place, the veratrum rhizomes are either crowned by a conical bud of unexpanded leaves, or by the fibrous remains of leaves which they once bore. These leaves at first sight bear some faint resemblance to those found at the end of the creeping shoots or stolons which are developed from the root-stock of the true valerian plant, and by which that plant is propagated ; but the leaves in the latter plant are opposite to each other, and overlap at their base, while those of veratrum form concentric sheaths, which are arranged one within the other. Moreover, in commercial specimens of valerian root, such stolons are rarely or ever found. The presence and arrangement of these leaves ought, therefore, at once to lead to the detection of white hellebore rhizomes when mixed with those of valerian.

Secondly, the white hellebore rhizomes are much larger than those of the valerian, and also entire; whereas the valerian are commonly more or less cut. The rhizomes of veratrum are also of a darker colour, and when of any length, marked below with the pits and scars of old roots.

Thirdly, a transverse section of white hellebore rhizome presents a large central woody or spongy portion of a whitish or pale buff colour, which is separated by a fine wavy-crenate ring from an outer broad white part which is coated by a thin dark brown or blackish bark-like portion. The appearance of this transverse section, particularly that of the undulating ring, is very different from a similar section of valerian rhizome, which, although whitish at first, presents in commercial specimens a dark brown, firm and horny central portion, separated by a dark interrupted cambial zone from the cortical part, which is also of a brown colour. A vertical section of veratrum rhizome is also very characteristic, and more especially so from presenting a fine, dark, wavy, conically arranged line running nearly its own length, and thus separating the outer from its central portion. No such wavy line is seen in valerian rhizome.

Fourthly, the roots of veratrum, which arise from the upper part of the rhizome only, are of a paler colour externally than those of valerian rhizome ; they are also commonly larger and more shrivelled.

Fifthly, the taste of veratrum rhizome and roots is at first sweet, then bitter, acrid, and somewhat numbing ; while the similar parts of valerian have no acridity, but are evidently aromatic and somewhat bitter.

Sixthly, the veratrum in itself has no marked odour, and although by its admixture with valerian root it has acquired the peculiar odour of that drug, it is feeble when compared with valerian itself. The veratrum rhizome also excites sneezing when cut or bruised, as found by its action in making sections to examine its structure.

There is one chemical distinctive character, which is so marked, and at the same time so simple and readily observed, that it will be useful to notice it. It is derived from the application of sulphuric acid to a transverse or vertical section of the two rhizomes. Thus, if the acid be added to a section of white hellebore, a deep orange yellowish red colour is at once produced from its action on the contained alkaloids, which soon changes to a dark blood red; but its application to a section of valerian is simply to heighten the natural colour of that drug.

The sample of valerian root which forms the subject of this paper weighed exactly forty-two ounces, of which thirty-four ounces were true valerian, and eight ounces white hellebore rhizome; so that the serious nature of the admixture may be seen at once. The sample also contained a few pieces of veratrum rhizome without any trace of leaves, but with the roots still attached; such pieces have of course a much greater resemblance to valerian root, but they can be readily distinguished, with ordinary care, by the different appearances presented on making a transverse or vertical section of the two rhizomes, and by the action of sulphuric acid.

Although it was impossible to determine with absolute certainty the species of veratrum from the specimen of rhizome under examination, the author has but little doubt that it was from some form of *Veratrum album*, and that both it and the valerian rhizome were gathered together.

Helianthus Annuus. (*New Remedies*, from *Archiv der Pharmacie*, 1876.) The cultivation of the sunflower (*Helianthus annuus*) is carried on extensively in some countries, as central Russia and Hungary, chiefly for obtaining the oil of the seeds, which forms an excellent salad-oil, while the residuary cakes find employment as food for cattle.

The yield is so large and the labour connected with its cultivation so trifling, that it deserves the attention of agriculturists. Each acre of land may easily contain 16,000 plants without at all interfering with each other. Numerous trials have shown that each fresh plant weighs on an average 10½ pounds, including the seeds, which amount to about half a pound. The yield of one acre may be stated as 80,000 lbs. of stems, 80,000 lbs. of leaves, flowers (excluding seeds), and roots, and 8000 lbs. of seeds. The stems and leaves contain a considerable amount of potassium nitrate, and are therefore easily reduced to ash, which will yield to water about 2300 lbs. of potash. There are two varieties of the plant, one containing white, and the other black and white seeds. The former contain from 25 to 28 per cent. of oil, the latter from 16·25 to 26 per cent.; but the amount of kernel varies in the two sorts. The average yield from 100 parts of kernel is about 44·6 per cent. of oil. But it must be understood that this percentage is the actual amount existing in the seeds, and extracted with ether. In practice, especially when pressure alone is resorted to, the actual yield will be somewhat less. Analysis of the ash of the plant (excepting the seeds) yielded the following results; the corresponding figures obtained from an analysis of the ash of the seeds, are added after each constituent in brackets:—potash, 47·687 (14·475); soda, 1·092 (6·119); lime, 9·851 (6·811); magnesia, 5·291 (1·0960); alumina, 0·280 (0·227); ferric oxide, 0·170 (1·427); chlorine, 5·004 (2·162); sulphuric acid, 1·344 (2·086); phosphoric acid, 6·968 (31·848); silica, 0·687 (10·811); carbonic acid, 21·626 (13·074).

Researches on Mancona Bark. N. Gallois and E. Hardy. (*Journal de Pharmacie et de Chimie*, July, 1876, 25.) The *Erythrophlœum Guineense* (sassy tree, or red-water tree) is a tall tree growing along the West Coast of Africa, and belonging to the order *Leguminosæ*. A previous notice of its bark will be found in the *Year-Book of Pharmacy*, 1876, p. 246. The bark is used by the natives for poisoning arrows and preparing ordeal liquors for criminals. By the following process the authors have isolated from it a crystalline alkaloid possessing marked poisonous properties:—

The finely powdered bark was macerated for three days with alcohol of 90 per cent. slightly acidulated with hydrochloric acid, the tincture pressed off and the residue subjected to second, and afterwards to a third, maceration in the same way. After filtering the united tinctures, the greater part of the alcohol was recovered by distillation from a water bath, and the remainder evaporated at a low temperature. A reddish-brown extract was thus obtained, rich in resinous matter. This was treated five or six times with lukewarm distilled water, and the liquor cooled, filtered, and evaporated on a water bath. When suitably concentrated it was again allowed to cool, decanted, saturated with ammonia, and poured into four or five times its volume of acetic ether, from which any acid present had been previously removed. After shaking several times the ether was removed by means of a funnel having a stopcock. The aqueous solution was then exhausted a second time with four times its volume of acetic ether. The ethereal solutions were filtered, evaporated on a water bath at a low temperature, and the yellowish residue treated several times with cold distilled water. The aqueous solution was filtered and allowed to evaporate in the vacuum of an air pump. Another process employed was that of Stas, with the substitution of acetic ether for ordinary ether after the saturation with carbonate of soda.

Erythrophleine thus obtained is a colourless crystalline substance, soluble in water, alcohol, acetic acid, and amylic alcohol; but only slightly soluble in ether, benzol, and chloroform. It combines with acids to form salts. With potassium permanganate and sulphuric acid it strikes a violet colour, less intense than that produced by strychnine under the same conditions; the colour soon changes to a dirty brown. Its behaviour with the usual alkaloid reagents is as follows:—

Picric acid: yellowish green precipitate.
Iodine, in potassium iodide: reddish yellow precipitate.
Iodide of mercury and potassium: white precipitate.
Iodide of bismuth and cadmium: flocculent white precipitate.
Potassium bichromate: yellowish precipitate.
Mercuric chloride: white precipitate.
Auric chloride: whitish precipitate.
Palladic chloride: white precipitate.

The assumption that erythrophleine might be a product from a natural glucoside, and not an alkaloid already existing in the drug, was shown to be untenable by tests applied directly to the infusion, and by actual separation of erythrophleine without the intervention of an acid.

Physiological experiments made by the authors on dogs and frogs show that erythrophleine possesses strong toxic properties, and indicate that it is a cardiac poison. Whilst curare retards the effects of mancona poison, atropine does not restore the movements of the heart paralysed by it.

Erythrophlœum couminga, or *koumanga*, is also a considerable tree of the same genus. All its parts are poisonous, and in the way indicated above the authors have separated an alkaloid which is closely related to erythrophleine, if not identical with it.

Ava, or Kava-Kava. (*Pharm. Journ.*, 3rd series, vii., 147.) The root known under the name of kava-kava has lately attracted some attention in France as a remedy for gonorrhœa, and will probably be tried in this country. It was first recommended for this purpose in 1857; but though notices of the plants yielding it (*Piper methysticum*) have appeared in several journals, a full description of the root and leaf for the purposes of pharmacognosy does not appear to have been given in any of the reports hitherto published.

The ava, or kava-kava plant, is cultivated in Viti, Tahiti, Hawaii, the Society and Tongan islands. Several varieties of the plant are distinguished by the natives. Those which grow on dry soil are said to produce the most active roots.

The *Piper methysticum* is a shrub about 6 feet high, with stems varying from 1 to 1½ inch in thickness. The leaves are rather large, varying in size from 4 to 8 inches in length, and being nearly as broad as they are long. In shape they are cordate, tapering above somewhat suddenly into a very short acute apex. The leaves are stalked, the petiole being usually from 1 to 1½ inch long, and dilated towards its base. To the naked eye the leaves appear smooth, although with the aid of a lens they are seen to have the veins covered with minute hairs, while the rest of the leaf has short hairs thinly scattered over it. The principal veins of the leaf, of which there are usually ten to twelve, radiate from the top of the petiole, the three central veins being very close together for about half an inch upwards from the base of the leaf.

The root is large and fibrous, but rather light and spongy in texture. When fresh, it is said to weigh usually from 2 to 4 lbs., although it sometimes attains as much as 20 lbs. in weight, or even more. In drying, however, it loses rather more than half its weight. Externally the root is of a greyish brown colour, and has a very thin bark, which when sliced off shows a complete network of woody tissue, some of the interstices of which are filled with soft yellowish white cellular matter, whilst others are quite empty. Internally the root is of a yellowish white colour. (In a variety of the plant known as "marea," it is citron yellow internally; and in another variety, know under the name of "avini-ute," it is of a pinkish colour). A transverse section shows a number of narrow lines (woody bundles) radiating from near the centre to the circumference, the portions of the soft cellular tissue, by which the lines are separated from each other, being much wider than the lines themselves. The central portion of the root is soft and cellular, with a few woody bundles anastomosing with each other and proceeding at right angles to the radiating bundles, so that they form a network in the centre of the transverse section. The root has a pleasant odour, recalling that of the lilac (*Syringa vulgaris*, L.), or meadow-sweet (*Spiræa ulmaria*, L.). It has a slightly pungent taste, and causes an increase in the flow of saliva, with a slightly astringent sensation in the mouth, and a scarcely perceptible bitterness. The root and extreme base of the stem are the parts generally used.

The form in which it has been used for medicinal purposes is an infusion made by macerating about one dram of the scraped root in a quart of water for five minutes. Unlike most other remedies for gonorrhœa, the taste of the infusion is pleasant, while its bitterness improves the appetite and does not produce nausea. The root contains, according to M. Cuzant, an essential oil of a pale yellow colour, 2 per cent. of an acrid resin, and about 1 per cent. of a neutral crystalline principle called kavahin or methysticin, which is obtained in acicular crystals by crystallization from a concentrated tincture. Kavahin differs from piperine and cubebin in being coloured red by hydrochloric acid—the red colour fading on exposure to air into a bright yellow, and in being coloured by strong sulphuric acid a purplish violet colour, which passes into green. The root contains also nearly half its weight of starch.

The action of kava root appears to vary with the amount taken. In small doses it is generally stated to act as a stimulant and tonic; but when taken in large doses it produces an intoxication, which differs from that caused by alcohol in being of a silent and drowsy nature, accompanied by incoherent dreams, the drinker not being quarrelsome or excited. The roots grown in damp soil, however, produce a slightly different effect, the drunken person becoming irritated by the least noise.

It appears probable that the medicinal properties of the plant are due neither to kavahin nor to the resin, since a watery infusion produces the characteristic effects of the drug; and neither kavahin nor the resin are soluble in water. The therapeutical properties of the different chemical constituents of the root, therefore, still require more accurate investigation.

The root is stated to have been used with success in erysipelatous eruptions (*Pharm. Journ.* [1], ix. 218), which is rather remarkable, since, when taken in excess as an intoxicating beverage, it produces a peculiar kind of skin disease, called in Tahiti, "arevarea." In old drinkers the vision becomes obscure, and the skin, especially in parts where it is thick, becomes dry, scaly, cracked, and ulcerated. In Nukahivi the natives use kava for phthisis and in bronchitis, a small dose being taken at bed time. It has also been recommended to be used internally and locally for gout (*Medical Times and Gazette*, Dec., 1854, 591). A figure of the plant and of sections of the root will be found in the *Pharmaceutical Journal*, pp. 149, 150.

Sium Latifolium, Gray. A. R. Porter. (*American Journ. of Pharm.*, August, 1876.) *Sium latifolium*, an umbelliferous plant, growing in California and along the Pacific coast, in damp and marshy places, commonly known as wild parsnip, was brought to the notice of the people there, about three years ago, by a man being poisoned by eating some of the root.

Sium latifolium has a short, upright root-stock, varying in size from one-half to two inches or more in length, and about the same in diameter, so it becomes almost spherical in outline; bases of leaves are still attached to the crown. It presents a very rough, wrinkled appearance, and is of a grey or yellowish brown colour. It branches at once into a number of large roots, from four to twelve, and even more. These are of the same colour, from ⅓ to ½ or ¾ inch in thickness, and 2 to 6 inches long, very much wrinkled longitudinally, somewhat flattened and contorted, and nearly uniform in thickness. On soaking in water they become about twice as large. The dried root breaks with a very short fracture, is white inside, with a yellowish, spongy meditullium and numerous resin cells, which are plainly visible with the naked eye, scattered irregularly throughout the bark. The root has rather an agreeable aromatic odour, and a sweetish, aromatic and somewhat pungent taste.

In attempting to separate the proximate principles of the root, an alcoholic tincture was made, concentrated and precipitated by water. In the clear aqueous solution, Trommer's test indicated the presence of much *sugar*, besides some colouring matter. The precipitated oleo-resin was distilled with water, the distillate containing some *volatile oil*, which was colourless, and had the aromatic odour and warm, pungent taste of the root. The soft residue was separated by hot petroleum benzin into a *fixed oil* and *resin*. The oil was thick, deep-red, of a slight odour and disagreeable taste, soluble in alcohol, chloroform, ether, oil of turpentime, benzin, and carbon bisulphide.

The resin was easily rubbed into a reddish brown powder, which had a very slight odour and but little taste; fusible when heated, and uncrystallizable; soluble in alcohol, chloroform, and ether; insoluble in benzin and bisulphide of carbon. This resin appears to be the poisonous principle, since a small portion of it given to a cat produced, in the course of two hours, frothing at the mouth, considerable pain, and then convulsions, from which, however, the cat recovered. The resin was not quite pure, since caustic potash dissolved only a part, leaving a portion insoluble, and not fusible by heat. The root exhausted by alcohol was found to contain *gum*, *albumen*, and *pectin*, but no starch.

An alkaloid having been searched for with negative result in the alcohol tincture, a decoction of the root was distilled with caustic potash. The distillate had an alkaline reaction, and its odour reminded of that of conium; but when neutralized with an acid, the distillate was neither precipitated by tannin nor by iodohydrargyrate of potassium; it was probably *ammonia* contaminated with some odorous product of decomposition.

Sium Latifolium. N. Rogers. (*Amer. Journ. Pharm.*, Nov., 1876.) The water parsnip is an aquatic plant very common in the swamps and along the water-courses of the valleys of the Pacific slope. Its root is creeping; stem erect, angular; leaf pinnate; leaflets ovate, lanceolate, sessile, smooth, serrate, sometimes pinnatifid; flowers white, large-rayed; involucres many-leaved; umbels terminal.

The leaves of the plant, when found growing in water, are generally bipinnatifid. In appearance, growth, odour, and taste it is closely allied to its innocent congener, the *Pastinaca sativa*. On account of this resemblance it has frequently been productive of dangerous results, when eaten through mistake for the harmless and nutritious root of that edible species.

The root being considered the most active part of the plant, it was deemed proper to subject that to a chemical examination.

A portion of the root cut up fine was introduced into boiling water contained in a retort, and a volatile oil obtained, which had a light straw colour, neutral reaction, and possessed a pungent odour, resembling somewhat the peculiar odour of carrots. A cold infusion of the fresh root, acidulated with hydrochloric acid, and filtered, to separate a precipitate, failed to give a precipitate with iodohydrargyrate of potassium; but when distilled with an excess of potash solution, a perfectly clear and colourless distillate was obtained, possessing a strong alkaline reaction and peculiar mouse-like odour, somewhat similar to that of conium; after neutralization with hydrochloric acid, however, not the slightest precipitate was occasioned by phosphomolybdic acid, iodohydrargyrate of potassium, or potassium cadmic iodide.

The neutralized distillate was next concentrated on a water bath, and then allowed to evaporate spontaneously over sulphuric acid, which resulted in the deposition of long, slender, colourless needle-shaped crystals. On the addition of milk of lime, a peculiar alkaline volatile principle was instantly liberated from its combination, and distinctly recognised by its disagreeable mouse-like odour, and the property of restoring the blue colour to reddened litmus.

Following Wittstein's process for preparing pastinacina, the alkaline distillate was freed from the volatile oil, neutralized with sulphuric acid, evaporated, and treated with etherized alcohol to remove ammonium sulphate; the filtrate evaporated to a syrupy consistency, and distilled with solution of potash, gave a distillate which possessed an alkaline reaction, a urinous odour, and a pungent taste. After neutralizing with sulphuric acid, needle-shaped crystals were obtained. This *alkaloid* appears to be analogous to pastinacina.

A spirituous tincture of the root was mixed with water, and the alcohol and volatile oil distilled off; the dark reddish brown resin removed from the aqueous liquid was soluble in ether and alcohol, and produced in the throat an unpleasant burning sensation. Weak ammonia dissolved from this *two acid resins*, which were precipitated,—the one by acetate, the other by subacetate, of lead. The portion insoluble in ammonia consisted in part of *an indifferent resin.* It was dissolved in alcohol, precipitated by a spirituous solution of lead acetate, the precipitate decomposed by sulphuretted hydrogen, and the sulphide of lead treated with boiling alcohol, from which, on cooling, shining colourless needles of a neutral principle separated, which were insoluble in pure and acidulated water, but soluble in ether, and from platinum foil volatilizable without charring. The aqueous filtrate from the resin obtained above was evaporated, and the residue incinerated; the ashes contained salts of *potassium*, *sodium*, *calcium*, and *magnesium*. On examining a section of the root under the microscope, *starch granules* we found to be quite plentiful around the medullary sheath and near the cortical portion. They polarized but feebly, were oblong, different in size, and quite small. *Sugar*, *albumen*, and *gum* were found in the cold infusion by appropriate tests.

Medical Effects.—From experiments made upon dogs, the volatile alkali and the neutral crystallizable principle were both found to be perfectly inert; while the resinous mass, in ten-grain doses, was found to lessen the frequency and the force of the heart's beat, producing also dizziness, vomiting, and purging, with slight convulsive movements. These poisonous symptoms having gradually disappeared, the animals were left in a prostrate, weakened condition, from which they slowly recovered.

Arrowroot. T. Greenish. (*Pharm. Journ.*, 3rd series, vii., 169.) The origin of the term arrowroot is involved in some obscurity, and its application to the starch derived from the maranta to the exclusion of that from every other source may be called in question.

It is generally admitted that the manihot, which yields the starch known as cassava starch, is a native of Brazil; if, therefore, the maranta be an introduced plant, which agrees with common report, the probability is that the term, "ara-ruta," which is unquestionably a native Indian word, originally applied to one or more varieties of the manihot; and if so, cassava starch has certainly equal claims with the maranta to the more popular and commercial name "arrowroot." The *Manihot utilissima*, Pohl., yields the cassava starch of commerce; it is also that used in the manufacture of tapioca.

Another variety of manihot yields a starch having a little colour; this is kept for home consumption. The author thinks it probable that at different periods, when a starch has been found capable of preparation so as to become an acceptable article of diet, the term "arrowroot" has been applied to it; and thus we have other starches which have long been designated by the name of arrowroot.

Brazilian arrowroot (manihot).
Tahiti arrowroot (tacca).
Portland arrowroot (arum).
East India arrowroot (curcuma).

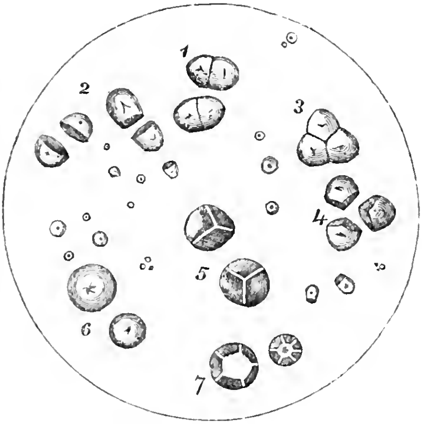
Some of these are rarely, if ever, found in commerce, although extensively used in the countries where they are produced.

The cassava starch has been found on several occasions mixed with that of maranta, and sold as arrowroot. One such case has been reported by Dr. Muter, and another by Mr. Jones, of Birmingham. It is beyond question that for some time marantas have been imported into this country adulterated with cassava. The author has several times detected it as an adulterant of pepper, and has also found it mixed with a maranta, but had no means of ascertaining whether this arrowroot was "as imported," or had been tampered with in this country.

The starch of the manihot, commonly called cassava starch, is one with which every pharmacist who has a microscope (and no pharmacy is complete without one) should be familiar. The accompanying woodcut shows the usual forms of this starch.

They are for the most part muller-shaped, with a fair sprinkling of the circular; some of the muller-shaped have truncate, others dihedral bases. If the starch be examined *in situ*, as in the meal of the cassava, there will be found a good many doublets and triplets as shown in the drawing; but these combinations are rarely present in a commercial sample of the prepared starch. The separation of the grains composing the doublet gives the muller-shaped truncated granules, and that of the triplet the muller-shaped with dihedral bases. The diameter of the granules ranges from 0·008 to 0·022 mm.

A very interesting and instructive experiment, with the view of determining the true forms of these grains to which the names muller-shaped and circular are given, may be witnessed with advantage. After having examined under the microscope a little of the starch, using as a medium a mixture of spirit, water, and glycerin, the single forms here given will for the most part be seen in the field of the microscope. If now a drop of alcohol be placed on the edge of the covering glass, capillary attraction will cause it to run in rapidly, and in its course the grains will be rolled over several times. It will be observed that a granule which appears muller-shaped when seen from the side, with the neuclus indicated by a spot or a fissure a little out of the centre, or eccentric, when rolled over so as to be seen with its crown towards the observer, appears circular; also that one of the triplet grains with a dihedral base, when seen with its base uppermost will give, with other grains having polyhedral bases, those angular forms of which the drawing indicates one or more examples. Careful illumination will occasionally show one or two zones indicating the lamination of the grain. If when the grains have ceased to revolve, another drop of spirit be applied to the opposite side of the covering glass, the movement will be repeated.



The starch of the tacca, called Tahiti arrowroot, is one resembling that of the cassava, but it is rarely found in commerce; the muller-shaped granules are, however, larger, and there are not proportionately so many circular ones. The diameter ranges from 0·026 to 0·045 mm.

The only other starch of this form is that of the *Castanospermum Australe*, or Moreton Bay chestnut. It was shown at the Paris exhibition; but from that time to the present it has not appeared as a commercial article, so that it is not likely by its presence to complicate matters, or embarrass the observer.

The author believes that all the cassava of commerce is the produce of *Manihot utilissima*, Pohl.

The Quinine Flower. D. Palmer. (*Amer. Journ. Pharm*, October, 1876.) The quinine flower is an annual from twelve to eighteen inches high, has an erect green stem, linear leaves of about one-half to an inch in length, and small white flowers. The root consists of numerous slender fibres.

It is a native of Florida, and is found most abundantly in flat pine woods, in a moderately dry soil, making its appearance in March or April, and flowering from July to September. The specimens furnished me were gathered three or four miles south of Monticello, in Jefferson county. In the lower portions of the county it is very abundant, and is successfully employed by those living in its vicinity for the cure of different types of malarious fever, the whole plant being used, either in the form of decoction or extract, and given *ad libitum* or until the patient feels the effects of quinine in his head. It is a curious fact that persons brought under the influence of this remedy experience similar sensations—such as tension or fulness in the head, ringing in the ears or partial deafness—as when under the influence of quinia, and hence its name. Its reputation as an antiperiodic was established during the late civil war, when, owing to the scarcity of quinine, every opportunity was offered for testing the relative value of various substitutes.

The quinine flower is intensely and permanently bitter, yielding its properties to water and alcohol. A saturated tincture in doses of one teaspoonful every two hours was found sufficient to break the paroxysm of intermittent fever. Larger quantities may be given in obstinate cases, or in the remittent form of the disease.

To the foregoing the following remarks are added by the Editor of the *American Journal of Pharmacy*:—

At our request Dr. Palmer has sent us some of the flowering plants referred to in the preceding paper. The plants are found to belong to the natural order of *Gentianaceæ*, and to the sub-order *Gentianeæ*, having the corolla lobes twisted (contorted) in the bud; the distinct style being deciduous, it must be placed into the section to which *Erythræa* and *Sabbatia* belong. Its botanical characters agree with those of the last-named genus, and more particularly with the group which has the white or purplish flowers scattered on alternate penduncles, and the corolla five-parted.

On comparing it with the American species in the college herbarium of Dan. B. Smith, it was found to correspond with a specimen of *Sabbatia Elliottii*, Steud., which is marked *ex herbar. Chapmani*. This plant is described in Chapman's "Flora of the Southern United States," as follows:—

"Stem low, terete, paniculately much branched from near the base, the branches diffuse; leaves small, sessile, the lowest obovate, the upper linear; lobes of the corolla three to four times as long as the short filiform calyx-lobes. (*S. paniculata*, Ell.) Open pine barrens, Florida to South Carolina. August and September.—Stems, ½ to 1½ foot high; leaves, from 3 to 6 inches long; corolla, 8 to 10 lines wide."

In both the herbarium specimen and the plants sent by Dr. Palmer, the calyx lobes are more prominent than might be supposed from the description given; but they are evidently described as *short*, in comparison with the much longer calyx lobes of *Sabbatia stellarus*, *gracilis* and allied species, in which they are about equal in length to the corolla, whilst in the species under consideration they are about one-third the length. The lowest leaves are obovate, those a little higher on the stem obolanceolate with an acute point, and become rapidly narrowed to a linear shape. The stems of the plants recently received are from 20 to 24 inches in height, and consequently rather exceed the height given by Chapman.

The herb has at first an herbacious taste, which gradually develops into a pure and persistent bitter, free from astringency.

The popular name *quinine flower* appears to be confined to a small locality, probably to only a portion of Florida. Porcher's "Resources of the Southern Fields and Forests," p. 556, however, mentions *Gentiana quinqeflora* under the names of *Indian quinine* and *Ague weed*, and states that "this and the *G. saponaria* are esteemed fully equal to the important gentian; in large doses they are said to be laxative; Dr. E. P. Wood, of Wisconsin, has given this plant with success in intermittent fever." He also gives a detailed account of the medicinal properties of *Sabbatia angularis*, the American centaury, and states that *S. stellarus* and *S. gracilis* possess properties similar to the former.

This genus of North American plants is closely allied to *Erythræa*, of which several species (*E. chilensis*, *E. centaurium*, *E. linarifolia*, etc.) are still employed in different countries as tonics, and sometimes as antiperiodics; but we do not remember that effects resembling quininism have been ascribed to any of those plants, such as Dr. Palmer states are experienced from the quinine flower of Florida.

Antiseptic Properties of the Root of Rubia Tinctorum. M. Rostaing. (*Comptes Rendus*, lxxxii., 551.) The author observed that a piece of meat placed in a jar containing powdered madder root kept perfectly good for seven months, during which time the jar was opened at least a dozen times. It had merely lost its moisture, its weight having decreased from 119 grams to 25 grams; but there was not the slightest sign of decomposition. He therefore recommends madder for the preservation of corpses and the disinfection of burial grounds.

Ergot in Atony of the Bladder. Prof. Langenbeck. (*New Rem.*, 1877, 207.) The author, at a meeting of the Berlin Medical Society, stated that in atony of the bladder, associated with enlarged prostate, in elderly men, in which the organ is never completely emptied of urine, he had lately tried the hypodermic injection of ergotin with most surprising results. In three cases the contractile power of the bladder was at once increased so as to enable the patient to discharge additional urine, and in a few days it had so augmented that very little urine was left behind. After one or two injections the improvement was considerable, and even a diminution in the size of the prostate seemed to have ensued. Dr. Israel said that he had derived the same benefit from the employment of ergotin, and referred to the case of a patient who was thus enabled to hold his water for three hours, whereas before he voided it every ten minutes.

Persian Insect Powder. R. Rother. (*Druggists' Circular and Chemical Gazette*, July, 1876.) The powdered flowers of *Pyrethrum caucasicum*, *roseum*, etc., have in the course of years attained celebrity as an insecticide.

The non-poisonous character of the powder widens its range of application to an unlimited extent, and places it prominently above the numerous, often highly poisonous substances used for the same purposes. Its general use has, however, been restricted by reason of its costliness.

Persian insect powder is analogous in its action to *Cocculus indicus.* Its contact promptly stupefies, and, if prolonged, death rapidly ensues. It appears to be harmless to the larger animals, but if much of its dust is inhaled, dizziness will result. That the substance must possess medicinal virtues cannot be questioned, and probably before long will be largely employed otherwise than as a vermin destroyer. The powder has never been thoroughly investigated. It was found not to contain an alkaloid nor santonin, so that its virtues were ascribed to the volatile oil it contains. Early last summer, the author made a preliminary examination of it, and by operating upon 3500 grains of the powder, obtained results which were recently confirmed by a second experiment upon 20 ounces of the material; but an altogether thorough investigation was cut short by an accident, through which most of the material was lost.

The author found that an aqueous percolate, as also an aqueous ammoniacal one, when treated with chloroform, ether, and benzine, gave no indications of an alkaloid soluble in these liquids. Three acid bodies were, however, isolated. An oleo-resinous greenish yellow acid, which the author denominates "persicein," was found, having the odour of the powder, and its sub-bitter taste. It is, however, not the active principle of the plant. This acid resin is soluble in ether, alcohol, and benzine, but insoluble in chloroform; it is instantly dissolved by ammonia and the fixed alkalies, from which acids, in not too dilute solutions, precipitate it milky white. It is somewhat soluble in water, imparting a greenish yellow colour, and its characteristic odour and bitter taste. It forms insoluble salts with the heavy metals.

A second acid was found; it has a light brown colour, and is nearly insoluble in cold water, slightly soluble in hot. It is soluble in alcohol with a red-brown colour, but insoluble in chloroform, ether, and benzine; water reprecipitates it from the alcoholic solution. It forms soluble salts of dark brown-red colour with ammonia and the fixed alkalies; acids, again, precipitate it from the solutions of its salts. Strong sulphuric acid dissolves it with dark brown colour; the addition of water precipitates it from this solution unchanged. Strong nitric acid acts on it with great energy, liberating nitrogen tetroxide in profusion, yielding a deep yellow solution, and an insoluble yellow acid, probably a nitro acid. This new acid is soluble in alkalies, from which acids again precipitate it. The yellow nitric solution was not examined. The writer designates this second acid as "persiretin." The powder was found to contain 4·3 per cent. of it. It is not the active principle, but a decomposition product of it.

A third and very soluble acid was found. This body the writer names "persicin." It is a glucoside, and is split by boiling with acids into persiretin and glucose. It appears to be a polybasic acid, forming an insoluble and a soluble lead salt. It is remarkable for having a pleasant odour resembling that of fresh honey. This acid is exceedingly unstable; contact with dilute chlorhydric acid in the cold or evaporation of its solution, or of its salts, converts it into perseretin and glucose. It is, therefore, almost impossible to obtain the free acid dry in a pure state. The colour of persicin is, in solution, light wine red, and that of its neutral salts dark wine red.

Plumbic acetate does not precipitate its neutral solutions, but diplumbic acetate produces a voluminous greenish white precipitate. Excess of persicin dissolves the neutral lead salt, forming a pale yellow solution, which on evaporation yields an amorphous mass insoluble in alcohol, which latter also precipitates the salt from its aqueous solution in yellowish white curdy flakes.

The acid potassium salt of persicin can be crystallized; it is also soluble in alcohol. The neutral salt is apparently amorphous, and but sparingly soluble in alcohol. Persicin gives a fresh coloured precipitate with argentic nitrate, which is insoluble in acetic acid, but soluble in ammonia. Persicin is soluble in alcohol, but insoluble in chloroform, ether, and benzine. It is apparently the active principle of the plant. The investigation was conducted by percolating the powder first with water containing ammonia. The aqueous percolate yielded nothing to chloroform. Addition of chlorhydric acid threw down the persiretin. After filtration, ammonia gave a crystalline precipitate of ammonio-magnesian phosphate.

The ammoniacal percolate had a ruby red colour. Addition of chlorhydric acid precipitated persiretin in great abundance, showing that the small amount extracted by water in the first percolation existed in combination with some base, but that the most of it is uncombined.

The acid filtrate was then treated with ammonia in excess, united with the first filtrate, and the whole evaporated on a water bath to a syrupy liquid. This residue, now having an acid reaction, was treated with alcohol, which produced a gummy precipitate and a dark red liquid. The solution was evaporated on a water bath to expel alcohol, slightly diluted with water, and shaken with ether. The ethereal solution, on spontaneous evaporation, yielded a residue of persicin. The aqueous residue was now shaken with chloroform, which after decantation and evaporation left no residue. The aqueous liquid was then treated with benzine, which took up the ether and chloroform held in solution; on evaporation no appreciable residue was left, thus showing the probable absence of alkaloids.

The liquid from which the benzine had been decanted was treated with chlorhydric acid, producing a slight turbidness; shaken with ether, it dissolved, and the yellowish ethereal solution yielded on evaporation more of the persicin. This result shows that the persicein taken up by the ether in the first instance had parted with the ammonia during the evaporation, and that the remainder could only be removed after its liberation by the chlorhydric acid.

The red acid liquid was now mixed with the filtered solution of the matter precipitated by the alcohol, neutralized with ammonia, and treated with diplumbic acetate as long as a precipitate formed; this was collected, washed, and treated with dilute sulphuric acid in slight excess, whereby the persicin was liberated, and the peculiar honey odour at once became perceptible. On evaporation on a water bath, a red acid residue was obtained; however, it was much contaminated with insoluble persiretin, into which a part of the persicin had been converted. The fresh solution of the persicin, neutralized with potassium hydrate and boiled with Fehling's solutions, yields an emerald green liquid, but no cuprous oxide. If the solution is, however, first boiled a few moments with dilute chlorhydric acid until it becomes turbid, then neutralized and boiled with Fehling's solutions, cuprous oxide is profusely precipitated. This makes it evident that persicin is a glucoside, decomposable into persiretin and glucose.

Xanthium Spinosum. M. Guichard. (*Répert. de Pharm.* [N.S.], iv., 513; *Pharm. Journ.*, 3rd series, vii., 249.) The author presents the following contribution to the chemical and pharmaceutical history of this new medicament which has recently been recommended as a remedy for hydrophobia.

The drug is met with in the form of stalks bearing leaves and numerous spines. There is room, therefore, for the study of the picked and unpicked drug, and to ascertain which of the two should be employed, as probably the activity of all the parts is not the same. Their yield in extract is very different,—20 grams of cleaned leaves gave with alcohol 5 grams, or 25 per cent., of green extract containing much chlorophyll. 150 grams of the uncleaned drug treated in the same way yielded also a green extract, but in less quantity, the yield being only 12 grams, or $7\frac{1}{2}$ per cent. The difference was due to chlorophyll.

The two extracts were prepared by coarsely powdering the plant, and treating it after twelve hours' maceration by displacement, first with 90 per cent., and then with 60 per cent. alcohol.

128 grams of the unpicked plant were treated by infusion, then pressed, and treated a second time. The product was evaporated on a water bath, and gave 50 grams, or 39 per cent., of extract.

The alcoholic extracts were very bitter; the aqueous extract scarcely so. The author therefore thinks that probably the alcoholic extract is the most active, and this appears to be borne out by the following preliminary experiments:—

The alcoholic extract redissolved in water was precipitated by iodized iodide of potassium, but not by cadmi-potassic iodide. The alkalies precipitated iron and alumina. When dried with calcined magnesia and treated with ether, an extract was obtained which, if redissolved in water acidulated with a few drops of hydrochloric acid, gave with the iodized iodide an abundant kermes coloured precipitate, and with cadmi-potassic iodide a dirty grey precipitate that separated rapidly like curdled milk. Ammonia precipitated the solution slightly.

If the above aqueous solution be allowed to evaporate upon a glass plate of a microscope, crystals are obtained of various forms, —such as needles grouped in crosses, or three-branched stars, and granular crystals; also some green colouring matter. The hydrochloric solution gives large square or rectangular tables, as well as acicular crystals. The liquid precipitated by ammonia contains a large number of amorphous points and numerous bundles of fine needles. The aqueous extract treated in the same manner gives no results. But the author considers that the preceding experiments demonstrate the presence of an alkaloid which he hopes soon to be in a position to isolate.

The mode of employment of the drug previously indicated was to administer 60 centigrams of the plant, finely pulverized, several times a day.

Xanthium Spinosum. Dr. Grzymala. The author has communicated to the *Journal des Débats* a most favourable report on the value of *Xanthium spinosum* as a remedy for hydrophobia. Upwards of one hundred persons were cured by it of this terrible disease. 0·3 gram of the powdered leaves is administered three times a day for several weeks. Of twelve hydrophobic patients in the hospital at Olschanka (in the district of Balta), six were completely cured by the administration of this herb; the other six died in spite of the application of cantharides, faba tonca, genista tinctoria, etc.

The Mineral Constituents of Xanthium Spinosum. Dr. R. Godeffroy. (*Zeitschr. des oesterr Apoth. Ver.*, 1877, 67.) The statement occurring in the *Pharmaceut. Zeitschrift für Russland*, 1876, 403, that the ash of *Xanthium spinosum* contained nitrates is contradicted by the author, who found in 100 parts of the ash,—

Calcium Carbonate	9·39
,, Sulphate	2·84
,, Phosphate (Ca_3PO_4)	13·18
Magnesium Carbonate	8·31
,, Chloride	1·07
Potassium Carbonate	25·00
,, Chloride	4·39
Sodium Carbonate	traces
Silica	19·73
Ferric Oxide	15·81
Aluminium Oxide	traces

Fucus Vesiculosus, and Allied Species. J. M. Maisch. (*Amer. Journ. Pharm.*, September, 1876.) Though Theophrastus already, in his history of plants, mentions several species of marine algæ, the sea wrack does not appear to have been employed medicinally before the first half of the eighteenth century; at least no mention is made of it in the new "London Dispensatory" of 1676. Russell seems to have been instrumental in introducing it into medicine through his essay, "*De tabe glandulari*," which was published in 1750, and in which he specially recommended *Fucus vesiculosus* in the form of charcoal and jelly; the former, known afterwards under the name of *Æthiops vegetabilis*, being prepared by heating the plant in a crucible closed with a perforated cover until smoke ceased to be given off, while the latter was made by expressing the mucilaginous liquid, and also by macerating the fucus in an equal weight of sea water for two weeks, or until it was converted into a kind of jelly, which was employed both externally and internally. Upon the strength of these observations, *Fucus vesiculosus* was admitted into several pharmacopœias, but was afterwards dismissed, the last one dropping it being the Dublin Pharmacopœia, in the edition of 1850. The beneficial effects in scrofulous swellings and goitre of the vegetable ethiops and of the sponge charcoal, which had been introduced by Arnaud de Villeneuve near the close of the thirteenth century, and the discovery of iodine in the ashes of sea plants, induced Dr. Coindet, of Geneva, in 1819, to study the effects of iodine, and led to the introduction of this element into medicine. Subsequently, Duchesne Dupare, and after him Godsfrey, stated

(1862) that they had found this fucus to possess valuable properties as a remedy for morbid obesity, an observation which, by later investigators, does not appear to be confirmed to the full extent mentioned by the first recommenders in this complaint.

Of late, the bladder wrack, it seems, has been employed medicinally to some extent in the United States; so that a brief description of this and some allied species may be desirable.

The genus *Fucus* belongs to the sub-order *Fucoideæ*, or melanosporeæ, of the natural order *Algæ*. As originally constituted by Linnæus, it embraced several genera which have been separated by later authors, and among which are the genera *Laminaria*, *Sargassum*, and *Cystoseira*, the last named having the thallus usually inflated into vesicles which often show a moniliform arrangement, while the vesicles of *Sargassum* are stipitate. *Fucus* has either a cylindrical (filiform) or flat, usually forking thallus, and the sporocarps inflated and usually terminating the branches. In their fresh state they have an olive or brownish green colour, becoming blackish on drying. Several species have portions of the thallus inflated so as to form hollow vesicles.

Fucus vesiculosus, Lin., attains the length of one to three feet, and has a flat thallus one-half to one inch wide, with the margin entire, and a distinct midrib running the entire length of the thallus; the vesicles are always in pairs, one being placed on each side of the midrib, spherical or oblong globular in shape, and occasionally attaining the size of a hazel nut. It grows on rocky sea-shores of the Atlantic Ocean, near high water mark, and in marshes which are occasionally overflowed by the tide. Formerly it was known by the name of *Quercus marina*, or sea oak, its common English names being bladder wrack, sea wrack, sea ware, kelp ware, and black tang. In Scotland and other northern countries it is used in winter for feeding horses, cattle and sheep, and is eaten by deer when other food is scarce.

F. nodosus, Lin., knobbed sea wrack, grows in similar localities, but at or near low water mark. It attains a length of four to six feet, and has a narrower veinless frond, with the branches almost filiform at the base, the vesicles single in the centre of the thallus, or frond, ovate in shape, and usually quite large.

F. serratus, Lin., has a veined and serrate frond, and is destitute of vesicles.

F. siliquosus, Lin. (s. *Cystoseira siliquosa*, Agardh), has a very narrow frond, two to four feet long, with short branches, articulated vesicles, and lanceolate flattened sporocarps.

F. natans, Lin. (s. *Sargassum bacciferum*, Agardh), the gulf-weed of the Atlantic Ocean, is often found in immense masses floating in the sea. Its frond is terete, with the branches linear and serrate, and the vesicles globular and aculeate.

All these and many allied species appear to be very similar in their constituents, of which they contain mucilage, mannite, odorous oil, bitter principle, and a considerable proportion of saline matter, varying from 14 to 20 per cent., calculated for the dry plants. According to Godeschen, James, and others, the variation is just as great for the bladder wrack as collected in different localities, and it is not impossible that this may be, at least in part, accounted for by having been collected in different seasons, the plant being assumed to be most active when collected after the sporocarps have formed, about the month of July. E. Marchand found (1865) in the ashes of *F. vesiculosus* 0·719 per cent. iodine and 0·603 per cent. bromine; in *F. siliquosus* nearly the same amount, and in *F. serratus* 0·834 iodine and 1·007 bromine; while the ashes of the fucoideœ, *Laminaria agitata*, Lamx., contained 5·352 iodine and 0·774 bromine, and *Lam. saccharina*, Lamx., about one-half these amounts. (See also *American Journal of Pharmacy*, 1854, p. 438.)

Bladder wrack has been employed in France in the form of extract, prepared, according to Dannecy, by exhausting the plant with 54 per cent. alcohol; it is stated to represent fifteen parts of the fucus (*Proc. Am. Phar. Assoc.*, 1863, p. 66); also in the form of syrup, suggested by Potier (*Ibid.*), by exhausting 150 parts of the powdered plant with 14 per cent. alcohol, evaporating the tincture to 230 parts, and dissolving in it 370 parts of sugar. 20 grams (one tablespoonful) of this syrup represents 0·6 gram of the extract and 5 grams of the fucus, which is the average dose. A fluid extract might doubtless be prepared by a process similar to the officinal one for fluid extract of chimaphila; the average dose of such a preparation would be about a teaspoonful. If, however, the virtues depend mainly upon the iodine and bromine present, the dose would have to be increased very considerably.

A New Alkaloid in Angostura Bark. MM. Oberlin and Schlagdenhauffen. (*Répert. de Pharm.*, 1877, No. 9.) The authors have isolated from the bark of *Galipea Cusparia* a crystallizable alkaloid which is soluble in ether, chloroform, and benzoline, and entirely different from Saladin's cusparine. They have adopted the same name (cusparine) for their own alkaloid.

Note on Sumbul. K. Wittmann. (*Pharm. Journ.*, from *Pharmaceut. Zeitschr. für Russland.*) After referring to a notice which appeared last year in the *Pharmaceutial Journal* (vol. vi., p. 43), respecting the blooming of the sumbul plant at Kew, the author, who is Secretary to the Military Medical District Administration of East Siberia, gives the following information :—

The *Euryangium sumbul* is found in large quantities in the neighbourhood of Chabarowka, a military post on the river Amur, in the province of Küsten, East Siberia, 9000 versts from St. Petersburgh. It is a perennial umbellifer, and grows to the height of from three to five feet. Its root is branched, fleshy, about eleven inches in circumference at the base, and three and three-quarter inches in diameter, with numerous rootlets, and covered with a brown bark. The root has a strong smell of musk, which by moistening with water is considerably increased. The stalk of the plant is always fleshy, equal in circumference at the base with the root, becoming gradually more slender towards the top. The leaves are more than twice pinnatifid; the pinnæ lancet-shaped, sharply serrate; the umbels with thirty to fifty rays; the flowers white and small.

Besides the *Euryangium sumbul*, the author has met with another umbellifer which resembles it very much in its entire habit, but may be distinguished by its smaller size, lighter leaves, and the absence of the musk-like smell of the root.

The Eastern Russian inhabitants call the *Euryangium sumbul* "bärarklane" (bear's claw), and use the root as a medicine. The Chinese living in the district use the root of the plant against various diseases, and call it "lsóumal-tschen-tuk." It is also used by the natives internally as a remedy for swellings; with them it bears the names "ofuokgi" and "ouchi." The author promises a future communication, giving the results of an examination of the separate constituents of the root as it is found in the district of Chabarowka.

Ailanthus Glandulosa in Dysentery. Dr. J. Dudgeon. (*Med. Times and Gazette*, October 28th, 1876.) The *Ailanthus* is a very common tree in north China, growing readily and rapidly, and attaining a considerable height. The Chinese note two varieties, the fragrant and the fetid. Two synonyms for the latter tree are given—"tiger's eye," from the resemblance of the facets, when the branches fall off from the main stem, to that animal's eye; and "great eye varnish," from which circumstance the French name "vernis du japon" may be derived. The Chinese name has no connection with the word *ailanto*, which is supposed in Europe to be its native name in China and India, and is thought to mean "tree of the gods." It is intensely bitter and astringent, of a warm taste, free from poison, and emits a disagreeable smell, from which latter circumstances its Chinese name is derived. The Chinese medical works recommend it as an antidote against sulphur, arsenic, and gold poisoning. It is said, also, to possess anthelmintic properties, and to be used in demonology against the supposed transfer of disease from a corpse. It is also useful in diarrhœa, prolapsus ani, and leucorrhœa. It is frequently prescribed alone; at other times in conjunction with other remedies, particularly *Radix hedysari* and the fruit of *Terminalia chebula*,—favourite remedies in diarrhœa and dysentery,—which increase its efficacy. It is strongly recommended in all cases of hæmorrhage, from whatever cause or locality. It is used, too, in gonorrhœa and spermatorrhœa, and in short, in fluxes in general. The part used is the inner white bark of the root and stem of the non-fragrant species. Whether taken in infusion or in a pill, it is invariably prescribed to be taken on an empty stomach, in congee or with milk or soft boiled rice. In the most severe cases it is taken in conjunction with *Castus amarus* and vinegar.

Pumpkin Seeds and their Active Principle. (From *Pharm. Zeitung*, 1877, No. 55.) The nature and location of the active principle of the pumpkin seeds appears to have been determined by Heckel, of Nancy, who has published an interesting memoir on this subject. In the French drug trade pumpkin seeds are derived from *Cucurbita maxima*, *C. Pepo*, and *C. moschata*, which are equally serviceable against tape-worm, while the black seeds of *C. melanocarpa*, or the seeds of the closely related genus *Cucumis*, are entirely devoid of medicinal value, since the two latter lack the very membrane in which the active principle resides. The seeds of the three first-mentioned species differ chiefly in dimensions and colour. Those of *C. Pepo* (pumpkin) are the smallest, having an average length of 6–7 millimetres, rarely as much as 20–25 mm.; they are oblong-ovate, have a groove along both edges, where they are thickened, and have a dirty white colour. The seeds of *C. maxima* are 18–25 mm. long, by 10–15 mm. broad, are regularly oval, and vary in colour from white to orange. *C. moschata* has slightly smaller seeds, 16–22 mm. long and 9–12 mm. broad, pure white, grooved, and the surrounding thickened edge of darker colour. These three varieties of seeds consist of a perisperm made up of four coats, and an embryo with two thick oily cotyledons. The most external coat of the perisperm is an exceedingly fine membrane, constructed from a single layer of oblong cells, which imparts to certain varieties a characteristic silver-grey appearance. Below this lies the tougher *testa*, made up from singularly polyëdric, finely incrusted cells filled with starch. Both of these coats are removed by washing the *dried* seeds, while the washing of *fresh* seeds removes also the next two coats. The first of these—the third coat, counting from outside—is dirty-white, of a loose and spongy texture, and consists of spherical reticulated cells. The *fourth* and innermost coat, finally, which has a dark green colour when fresh, changing gradually to greenish yellow, has a chartaceous appearance and consists of two layers: the outer one made up of hexagonal or pentagonal cells with moderately thick walls, including chlorophyll and *a resinous mass;* the inner one formed by elongated cells, including starch. The resinous mass in the outer layer of the fourth or innermost coat of the seeds is, according to Heckel, the active tænicidal principle, and not, as has been supposed, the fatty oil residing in the cotyledons. Owing to the absence of this papyraceous membrane, which alone contains the resin, in other cucurbitaceous seeds, these latter are inert. At the same time it is shown that even active seeds become inert, when they are blanched in a fresh state, as *all* the coats are thereby removed.

Maté, or Paraguayan Tea. Dr. Bialet. (Abstract of a report in the *Revista Farmaceutica; Pharm. Journ.*, 3rd series, vii., 4.) The maté, or Paraguay tea tree (*Ilex mate paraguayensis*) is a small tree belonging to the family of *Celastrineæ*, which reaches at the most a height of seven metres; ordinarily it does not exceed four or five. Its trunk is about twenty centimetres in circumference, and is covered by a whitish bark. The leaves are oblong, cuneiform, obtuse, and finely dentate. It has axillary multipartite peduncles; calyx tetrasepalous; the corolla with four petals in the form of a crown; stile, none; stigma, four-fid; fruit, a four-seeded berry. The plant grows very abundantly in Paraguay, North Corrientes, Chaco, and South Brazil, where it forms woods called "*zerbales*."

According to Dr. Mantegazza, maté is prepared in Paraguay in the following way:—The entire trees are cut down, and the small branches and shoots are taken with the leaves and placed in the tatacúa, a plot of earth about six feet square surrounded by a fire, where the plant undergoes the first roasting. From thence it is taken to the barbacúa, which is a grating supported by a strong arch, underneath which burns a large fire; here it is submitted to a particular torrefaction, determined by experience, which develops the aromatic principle. Then it is reduced to a coarse powder in mortars formed of pits dug in the earth and well rammed.

It is next put into fresh bullock skins, well pressed, and placed in the sun to dry. The packages (*tercois*) thus obtained, which weigh 90 to 100 kilograms, are very compact; and have an average value in commerce of one to two dollars the kilo., according to quality; those of Paraguay and Missiones being the better, or least hurtful, those of Oran and Paranaguá being much more prejudicial to health.

Of all the analyses of maté that have appeared in books, Dr. Bialet considers not one, up to the present time, deserves much credit. Senor Arata, however, who has devoted much time and skill to the subject, has placed the following data at his service:—

Maté contains in 100 parts:—

Organic combustible substances	91·685
Ash	8·315

The ash contains:—

Calcium Oxide	12·344
Magnesium Oxide	11·395
Sodium Oxide	7·281
Potassium Oxide	2·984
Manganese Oxide	2·500
Ferric Oxide	3·410
Sulphuric Acid	0·926
Hydrochloric Acid	0·716
Phosphoric Acid	5·540
Carbonic Acid	8·150
Sand, Silica, Carbon, and loss	44·754

It will be understood that the enormous relative quantities of sand found in the analysis is a result of the mode of preparation in excavations made in the soil.

The plant contains:—

Principles soluble in Ether	9·820
,, ,, Alcohol	8·432
,, ,, Water	26·208
,, ,, Water acidulated with Hydrochloric Acid	7·260
In solution of Caustic Soda	16·880
Cellulose	13·280
Water	9·000
Sand	9·120
	100·000

Among the soluble principles is an average of 1·300 of caffeine. The quantity, however, was found to be very variable in different plants analysed; the Paraguay and Missiones contained the most, and the Paranaguá and Argentine the least. Senor Arata has made a careful search for caffeic acid, and the caffeates that some say they have found in maté, but hitherto always with negative results; the same remark applies to the examination for a volatile acid.

The tannin of maté is peculiar; it does not tan hides, and requires a special method for its estimation. The average amount obtained by the ordinary method is not more than 12 per cent.; but the whole quantity present amounts to about 16 per cent.

Maté contains also a large quantity of a peculiar fatty matter, not entirely saponifiable by potash, besides pectic matters.

Comparing maté with the other caffeic substances, it ranks between coffee and tea for the proportion of caffeine it contains, and has the largest proportion of mineral salts.

The action of maté, like that of all other caffeic substances, is upon the nervous system, but though it contains a large quantity of caffeine it does not exalt the peripheric nerves like tea, nor the cerebric like coffee; but rather contributes in a high degree to the indolence and drowsiness of the ordinary drinkers of maté, whose mental faculties become at length disarranged and impoverished to a lamentable degree. It accelerates the cardiac contractions, producing many more affections of the heart than tea or coffee. Upon the digestive organs, it acts variously; no other beverage disturbs them so much, though there are persons who can tolerate its use. It accelerates the peristaltic movements, and produces an irritation of the organs generally. These effects are produced in whatever way the maté may be taken; but the most injurious effects are produced upon the mucous membrane, when the maté is taken hot and is sucked through a "bombilla," as it then passes into the stomach uncooled by previous contact with the mouth.

When the use of maté is prolonged, it becomes an imperious necessity, such a gloominess following abstention from it, that habitual drinkers would rather go without food than without maté. The moderate use of two or three doses a day during the summer heats or great fatigue is convenient, but it should be taken from a cup. It adds to the disadvantage of the "bombilla," that by indiscriminate use of the same bombilla by different persons, it may become the vehicle of contagion for the most repulsive complaints.

The Seeds of Ricinus Communis. E. L. Boerner. (From an inaugural essay: *Amer. Journ. Pharm.*, Nov., 1876.) The acrid principle of ricinus seeds is but in a slight degree extracted in the expression of the oil; and the residual marc, as left by the manufacturer of castor oil, would, therefore, contain the greater portion of it, and was the material operated upon.

The coarse particles which were liable to interfere with percolation being rejected, four different portions, of 1000 grains each, were treated respectively with gasolin, bisulphide of carbon, ether, and alcohol, until exhausted; the various menstrua evaporated, and the residues weighed, yielding from gasolin, 6·9 per cent.; bisulphide of carbon, 11·77 per cent.; ether, 14 per cent.; and alcohol, 21·2 per cent. The first three appeared to be pure oil, and were of a light yellow colour, while the alcohol residue was much darker, and contained considerable colouring matter, which was deposited upon standing.

The marc which had been exhausted with gasolin was further treated with bisulphide of carbon, resulting in an additional 5·37 per cent. of oily residue, from which, after a few days' standing, acicular crystals separated, which were insoluble in gasolin, partly soluble in ether and in alcohol. A second attempt to obtain the crystals was unsuccessful. That portion of marc which had been treated with bisulphide of carbon yielded nothing to gasolin upon subsequent treatment with this menstruum.

A portion of exhausted marc was macerated with water until decomposed, requiring for the process about fourteen days. It was then strained, to separate coarser particles, and distilled; the distillate, having an acid reaction and an odour resembling that of decayed cheese, was treated with carbonate of zinc, and filtered; upon concentration of the filtrate, crystals of butyrate of zinc separated. Both crystals and mother-liquor, when shaken with sulphuric acid and alcohol, immediately developed in a marked degree the odour of butyric ether. A portion of this ethereal liquid, neutralized with ammonia, was unaffected by the addition of ferric chloride, thus indicating the absence of an acetate.

An experiment was made similar to the one of Professor Tuson, in which he found a crystallizable substance supposed to be an alkaloid.

A portion of the marc was boiled with successive portions of water, the several liquids strained through muslin, and the resulting decoction evaporated to the consistence of a soft extract, which was exhausted with boiling alcohol. Upon standing, a substance of a resinous appearance, but soluble in water, separated from the filtrate, and was removed by a second filtration. The filtrate was concentrated, and, as no crystals separated, magnesia was added, the mixture evaporated to dryness, again exhausted with boiling alcohol, and filtered, when, upon concentration and a few days' standing, colourless crystals, having the form of rectangular prisms and tables, separated, answering to the appearance of those obtained by Professor Tuson. These crystals were slowly soluble in hot water. In an acidulated solution of the crystals, phosphomolybdic acid, tannic acid, and iodohydrargyrate of potassium produced neither a precipitate nor a coloration; while in the mother-liquor precipitates were at once formed by the two first-named reagents, but by the last one only after some hours, and in amount about one-eighth that formed by the phosphomolybdic acid. The mother-liquor, when heated with solid hydrate of potassium, developed the odour of ammonia. From these results the writer concludes that the crystalline substance in question is not an alkaloid.

A substance resembling emulsin was obtained by forming an emulsion of the marc with water, adding an equal bulk of ether, and agitating repeatedly for twenty-four hours, when, upon standing, the liquid separated into two layers; the supernatant liquid being removed, alcohol was added to the other, which precipitated the emulsin. This emulsin, with amygdalin, in the presence of water, developed the odour of hydrocyanic acid after several days' standing. The result of Mr. H. Bower (*American Journal of Pharmacy*, 1854, p. 208) is confirmed by this experiment.

The residue obtained from the alcoholic percolate having deposited a semi-solid portion largely composed of colouring matter, was agitated with ether, which took up the oil. The part left undissolved by the ether was treated with successive portions of alcohol until but a few grains were left; this, containing a number of minute crystals, and having a very sweet taste, was dissolved in water. The application of Trommer's test proved the presence of sugar. A drop of the aqueous solution, placed on a microscope slide and evaporated, plainly revealed the presence of cane sugar.

As the best authorities agreed in placing the amount of fixed oil obtained from the kernels of the seeds at less than 50 per cent., it would seem that, as more than 11 per cent. is obtainable from the marc as rejected by the manufacturer by treatment with bisulphide of carbon, the latter oil could be produced at a less cost than an inferior quality of the expressed article, and answer the same purpose for use in the arts.

The writer intends making further experiments to determine the amount of butyric acid obtainable from the marc, by a process similar to the one above described.

New Italian Variety of Liquorice Extract. A. Peltz. (*Pharm. Journ.*, from *Pharmaceut. Zeitschr. für Russland*, xv., 257.) The author reports on a new variety of liquorice extract which he had received for examination from a Russian wholesale house. It occurs in irregular masses, is rather tough, but can be cut with a knife; has a dull appearance, and possesses a purely sweet, not burnt, taste. On dissolving it in water it left but a very small residue; and the solution, when evaporated on a water bath yielded 75 per cent. of extract dried at 90° C. The undissolved residue was washed with a weak solution of ammonia, then boiled with water, and the liquid tested with tincture of iodine, which gave a distinct indication of starch.

To ascertain the amount of glycyrrhizin 10 grams of the liquorice were dissolved in water, filtered, the filtered solution mixed with a sufficient quantity of dilute sulphuric acid, and the precipitate collected on a filter and washed. As this did not give the glycyrrhizin sufficiently pure, the precipitate was again dissolved in weak solution of ammonia and reprecipitated with sulphuric acid. This precipitate was dried, triturated with one-third of its weight of barium carbonate, and extracted with hot absolute alcohol. The alcoholic extract evaporated to dryness gave 1·5 gram of glycyrrhizin.

The amount of sugar was ascertained by means of the copper solution to be 10 per cent.; the loss in moisture when dried at 100° amounted to 14 per cent.

The following table shows the position of the new substance in relation to other commercial liquorices :—

Variety.	Moisture per cent.	Dried Extract per cent.	Glycyrrhizin per cent.	Starch per cent.	Sugar per cent.
English . .	1·2	38	2·44	27·10	13
Calabrian. .	2·0	47	1·33	35·50	11
Bayonne . .	3·7	48	2·19	35·10	14
Astrachan. .	7·3	50	18·14	1·33	12
Spanish . .	4·12	55	3·15	8·85	14
Kasan . .	4·5	57	14·74	2·62	14
Sicilian . .	4·1	60·5	4·67	5·00	16
Baracco . .	3·7	67·5	4·95	13·12	15
Morean . .	—	79·0	11·88	5·33	16
Italian . .	14·0	75·0	15·0	2·50	10

It will be seen that though the Morean variety yields more extract, it is accounted for by the amount of sugar; whilst the Kasan variety, which contains almost the same amount of glycyrrhizin as the Italian, has the disadvantage of an unpleasant, almost tarry taste. The new article, notwithstanding its good qualities, is said to have been offered at a low price.

Megarrhiza Californica, Torrey. J. P. Heaney. (Abstract of an inaugural essay: *Amer. Journ. Pharm.*, October, 1876, 451.) This plant, better known by the synonyms of the "big" or "giant root" and "manroot," is a herbaceous, climbing, and succulent vine, growing abundantly throughout the State. It is closely allied to the echinocystis of the Eastern States, and also to a new species called *Marah muricatus*, or California balsam apple, which has been described by Dr. Kellogg in the proceedings of the California Academy of Natural Sciences (vol. i.). It is found both in dry, sandy, and rich soil. In the former it grows in bushy tufts, about two feet high and four or more wide, being evidently somewhat stunted; but in rich soil, when well shaded, its annual stem climbs thirty to forty feet over trees, and acquires its largest growth. It flowers in March and April.

The most remarkable feature of this plant is its gigantic root, which is perennial, tubero-fusiform, externally of a yellowish grey colour, and rugose; within white, succulent and fleshy, of a nauseous odour, which is lost in a great measure by drying, and of a bitter, acrid, and disagreeable taste, which leaves a feeling of acridity in the fauces. The Indians are said to use this root as a drastic purge in dropsy. It has also been used by domestic practitioners, in the form of decoction, both as a laxative and cathartic, with good results. On drying, the root lost from 70 to 75 per cent. in weight. The dried root is externally of a yellowish brown colour, and longitudinally wrinkled; internally of a white colour, becoming somewhat darker by age, concentrically striated, light, brittle, and readily pulverizable, yielding a whitish powder.

A preliminary examination made with aqueous, alcoholic, and ethereal extracts of the fresh root, led to the following conclusions, namely:—

That the root contained a bitter principle soluble in water and alcohol, but more readily in the latter; also a resinous, fatty matter and an organic acid, probably of a fatty nature, which was soluble in and extracted both by alcohol and ether. The probable presence of gum and pectin was likewise indicated, as well as the absence of albumen, sugar, and volatile oil.

Examination of the Dried Root.—A quantity of the powdered dried root was first treated with ether until thoroughly exhausted by this menstruum, in order to remove the fatty and resinous matter. The ethereal tincture had a lemon yellow colour, and left, on evaporation, a yellowish brown residue, which possessed the characteristic odour of the root, a slight bitter taste, was brittle, and had an acid reaction.

To determine the nature of the free acid, the residue was treated with a weak solution of sodic carbonate, and filtered from the insoluble portion. To the filtrate a sufficient quantity of tartaric acid was added, when whitish oily globules were observed on the surface of the liquid. These had an acid reaction, possessed a disagreeable odour, and gave to paper a stain unaffected by heat. The author names it *megarrhizic acid.* The portion insoluble in sodic carbonate was treated with a solution of caustic potash, in order to effect the saponification of the fatty matter, and the insoluble resinous substance was removed by a filter, washed, dried, and reserved to be examined subsequently. To the solution of soap obtained was added a sufficient quantity of tartaric acid to decompose it. Ether was now added, and the mixture agitated. After a few hours the supernatant ethereal liquid was removed and allowed to evaporate spontaneously, when it was found to possess properties characteristic of fatty acid bodies. The insoluble resinous substance obtained before was first boiled with water, then thrown on a filter, well washed and dried. It was afterwards dissolved in ether, and the solution decolorized by animal charcoal. The filtrate was evaporated, the residue redissolved in alcohol, and then allowed to evaporate spontaneously, when it left a deposit exhibiting under the microscope a rhomboidal crystalline structure; it is evidently a resin. This *megarrhizitin* is soluble in alcohol and ether, and is unaffected by alkalies and solution of cupric sulphate.

The root, previously exhausted by ether, was next treated with alcohol (sp. gr. 0·835), until deprived of its bitter taste. The tincture was evaporated to a small bulk, then thrown into water to remove traces of fat or resin, and afterwards filtered. The liquid was heated to expel the spirit. To the resulting aqueous fluid was added a concentrated solution of tannic acid. A bulky, gelatinous precipitate was obtained. This, being removed by a filter, was well washed and dried. It was now dissolved in alcohol (95 per cent.), the tannin thrown down by plumbic subacetate, the excess of lead removed by H_2S, and the liquid filtered and evaporated. The residue well washed with ether yielded the bitter principle pure. This process was adopted from that of Dr. Waltz, as mentioned in his analysis of colocynth.

To the principle thus obtained the name of *megarrhizin* is given. It is of a brownish colour, somewhat transparent, brittle, and friable, yielding a yellowish brown powder. It is fusible below 100° C., inflammable, more soluble in alcohol than in water, both solutions being intensely bitter. It is insoluble in ether. The following reactions with reagents were obtained: H_2SO_4 dissolved it slowly, with the production of first a bright red, and afterwards a brown colour; HCl gave a faint violet colour; HNO_3, a yellow dull colour. An aqueous solution of it produced with ferric chloride a deep colour, but no precipitate; with plumbic acetate and subacetate, mercuric chloride, solution of iodine, potassa or its carbonate, or argentic nitrate, no change; with tannic acid, a bulky, gelatinous precipitate, and with bromine water, a white, insoluble precipitate. Boiled with baryta water, decomposition ensued; treated with dilute H_2SO_4 or HCl, no change was observed in the cold, but upon boiling, immediately decomposition took place, yielding glucose and an insoluble substance, which may be called *megarrhizioretin.*

This *megarrhizioretin*, when washed and dried, possesses a dark brown colour, a resinous appearance, and is somewhat brittle. Alcohol dissolves it, but ether is only a partial solvent of it, leaving an insoluble portion behind. It is therefore a complex body.

The ashes showed, on analysis, the presence of magnesia, lime, iron, potassa, soda, chlorine, sulphuric and phosphoric acids, also a silicious residue.

It will be seen from the foregoing that megarrhizin belongs to that class of substances known as glucosides, to which belong also colocynthin and bryonin, and that it agrees with these two in many of their chemical and physical properties. But megarrhizin differs from colocynthin in the fact that colocynthein, the insoluble resinous substance obtained from the boiling of it with diluted acids, is soluble in ether, while megarrhizioretin is but partially soluble in that liquid, thereby agreeing with bryoretin. But it differs from bryonin principally in the behaviour to sulphuric acid, which dissolves megarrhizin, yielding a brown colour; while bryonin produces with it a blue colour. Therefore it was concluded to be a distinct principle.

Physiological Properties.—A sample of the extract prepared from an alcoholic tincture, and also some of the bitter principle, were examined physiologically, with the following results:—The extract in large doses is a powerful irritant, causing gastro-enteritis and death. It produces griping pains in the stomach, nausea, vomiting, and profuse diarrhœa, violent strangury, with other symptoms of renal and vesical irritation. Given in a quarter to half grain doses, the extract is a drastic hydragogue cathartic, causing nausea, sometimes vomiting, griping pains, and copious watery stools. In smaller doses, frequently repeated, it is a diuretic and laxative. Notwithstanding its activity, it is a safe and convenient purgative, and useful in all cases where it is desirable to produce an energetic influence on the bowels, to obtain large evacuations. Its hydragogue properties must prove beneficial in dropsies. It also augments the urinary discharges. In intestinal inflammations it should not be used.

Cortex Radicis Granati. (*Pharm. Zeitung*, Sept. 23rd, 1876, 659.) This bark deserves the first place among the remedies for tapeworm. It is true that some practitioners have given it up in favour of kousso, but the cause of this must be sought in the age of the bark employed by them. The fresh bark only, and especially that of the roots of trees not less than ten or twelve years old, can be thoroughly depended upon for its effects. 60–80 grams of the fresh bark should be digested with 750–1000 grams of water for 12 hours, then boiled for an hour, and the decoction evaporated to 300 grams. The resulting strong decoction is mixed with 30 grams of castor oil and a sufficient quantity of gum for emulsifying the oil, and the whole taken first thing in the morning, a suitable diet having been observed during the previous day. It is useful to touch the worm now and then with a drop of a mineral acid during its elimination.

According to an analysis by Cemedella, the bark contains in 100 parts: wax. 0·8; resin, 4·5; mannite, 1·8; uncrystallizable sugar, 2·7; gum, 3·2; inulin, 1·0; vegetable mucus, 0·6; tannic acid, 10·4; gallic acid, 4·0; extractive, 4·0; malic acid, pectin, calcium oxalate, 4·5; cellulose, 51·6. It is occasionally adulterated with the bark of *Berberis vulgaris*. The true root-bark of *Punica Granatum*, when fresh, is pale yellow, or greenish yellow internally, and greyish yellow externally. To water it imparts a yellow tint, which changes to blackish blue on the addition of ferrous sulphate, and to pink passing to yellow on the addition of acids. The stem bark and the rind of the fruit are useless as anthelmintics, but possess tonic and astringent properties.

Adulterations of the Rhizomes of Imperatoria Ostruthium. (From *Pharmaceut. Zeitung*, 1877, 224.) The rhizomes of masterwort, *Imperatoria Ostruthium*, which were formerly officinal in the Edinburgh Pharmacopœia, and are still so in the Pharmacopœia Germanica, are liable to frequent and extensive adulteration in consequence of the careless and indiscriminate manner in which they are collected in Switzerland. The admixtures most frequently detected by the writer were those with aconite root and veratrum rhizome. As small particles of these are more difficult to distinguish from masterwort than the larger pieces, any such particles which do not permit of a proper identification ought to be rejected.

The roots of *Gentiana punctata*, *Gentiana purpurea*, *Pimpinella saxifraga*, *Meum athamanticum*, *Libanotis montana*, and the rhizomes of *Polygonum Bistorta*, have also been observed as occasional admixtures in this drug.

The Gums of Senegal. Dr. A. Corre. (*Pharm. Journ.*, from *Journ. de Pharm.* [4], xxiv., 318.) In commerce the gums of Senegal are distinguished according to the district which yields them, or the port from which they are exported. They are:—(1) GOMMES BAS-DU-FLEUVE (Bas-du-fleuve, Degana, and Podor: gums from the desert of Bounoun and the country of the Braknas); and (2) GALAM GUMS, or GOMMES HAUT-DU-FLEUVE (Galam, Podor, Bakel, and Medina). These gums, when carefully sorted, yield very different products, which the author classifies as follows:—

A first group includes the gums in round pieces (*en boules*, so-called because of their form). The subdivisions of this group are regulated by the degree of consistence and resistance, size and colour, of the balls.

A. HARD GUMS (*Gommes dures*), of firm consistence, with large, clear, shining fracture:—(1) *grosse blanche:* pieces large or medium sized, entire, white or yellowish white; (2) *petite blanche:* pieces small, entire or in fragments, generally whiter than the preceding; (3) *grosse blonde:* pieces large or medium sized, entire, yellowish or reddish yellow; (4) *petite blonde:* pieces small, entire, or in fragments, yellowish or reddish yellow; (5) *deuxième blonde:* pieces more or less large, entire or in fragments, reddish; (6) *fabrique:* pieces more or less large, entire or in fragments, reddish or brownish, moderately limpid, grumous or tearlike on the surface, with a fracture often resinoid, uneven, and dull.

B. SOFT OR FRIABLE GUMS (*Gommes molles ou friables*).—(7) *blanche;* (8) *blonde;* (9) *fabrique.*

In a second group the author places the gums occurring in elongated masses, a form which results, doubtless, through delay in the solidification of the gum upon the tree, caused by rains or humidity of the atmosphere:—(10) *larmeuse:* in mamillated or undulated masses, clear light yellow colour, shining at the surface, fracture clean, hard; (11) *vermicelle:* rather dull white, surface corrugated, fracture pretty clean and shining, friable; this gum is remarkable for its convolute form, which resembles that of vermicelli.

To a third group belong the gums in fragments and powder, the *débris* and residue of the preceding:—(12) *gros grabeaux;* (13) *moyens grabeaux;* (14) *menus grabeaux;* (15) *grabeaux triés;* (16) *grabeaux frabrique;* (17) *poussière.*

To a fourth group is allotted (18) *mùrrons* or *bois*, a largish gum, frequently of resinoid aspect, yellowish or brownish, mixed with, or adherent to, fragments of bark.

The Senegal gums are collected from a great variety of plants. The acacias (*Acacia nilotica*, *Verek*, *Adansonii*, *albida*, *dealbata*, *Sing*, *Seyal*, etc.) yield the greater part, and the finest qualities They are also obtained from the *Khayà senegalensis*, certain *Spondias*, some *Sterculiaceæ*, and perhaps *Bassia*, etc.

As the result of the study of the mode in which the gum is produced from the verek, the author is of opinion that the starting-point is certainly in the cambium. When a transverse incision is made in a young branch, there is observed at first a sort of exudation, badly defined, between the wood and the bark. As the exudation becomes more considerable it raises the bark, and makes its way to the exterior through any cracks or fissures. But as there are two layers in this zone—a ligneous and a cellular layer—the question arises in which layer does the gum take its origin? For the following reasons, the author believes it to be formed in the ligneous layer at the expense of the crude sap circulating therein:—

1. Upon different specimens of verek he has observed that at the level of the base of the gummy exudations the exterior woody bundles become deviated in the form of a capsule, and present traces of an erosive or destructive action. In very young branches, by the aid of a microscope, these bundles may be distinguished, dissociated and jagged, in the midst of the gummy matter.

2. The balls of gum are frequently marked with very regular cavities, similar to those produced in a viscous mass by blowing air into it through a slender tube. These cavities cannot be due to the penetration of a gas coming directly from without, for they face inwards, *i.e.*, towards the base of the exudations; they could only be produced by the air from the vessels of the sap wood, ruptured and dissociated at the same time as the woody fibres.

3. The mineral elements of gum (lime, etc.), belong to the crude sap.

Gum, however, is not simply water charged with salts, neither is it a highly concentrated saline solution. It is a product that presents great analogy of chemical composition with lignose. The author, therefore, considers gum to be the result of a kind of liquefaction of the elements of the sap wood by the crude sap.

It is incontestable that the formation of gum is connected with an anomalous state due to excess of nutrition. It is observed more particularly at the points of budding, and at the bifurcation of the branches, and it acquires a remarkable development upon abnormal nodosities; in fact, wherever the nutritive action exists in the greatest intensity. Beyond certain limits, this energy in the rising of the sap is accompanied by a slackening of the circulation, which leads to a stagnation of the liquid through the engorgement of the channels; hence, perhaps by absorption, leading to the softening and liquefaction of the fibrous and vascular element of the sap wood.

In this phenomenon the easterly winds have a share, their high temperature and dryness favouring the determination of the sap to the exterior. Their influence is not, as often stated, limited to the production of cracks in the bark. It will be seen that there is a great analogy between the mode of the formation of verek gum and that of the gum of rosaceæ, as described by Trécul.

Recently an important part in the production of Senegal gums has been attributed to a loranthaceous parasite, which is met with frequently in eastern Africa, not only on gum trees, but also on guava trees, palms, etc. The author has never observed the least exudation of gum at the points of implantation of this parasite, which itself takes up sap and leaves no excess for the plant on which it is developed. The nodosities, which have probably been attributed to the action of this parasite, and thus led to the suggestion, the author considers to be the result of insect punctures.

The Preparation and Toxic Effects of Gelsemine. T. G. Wormley. (*Amer. Journ. Pharm.*, April, 1877, 150.) The author has formerly shown that *Gelsemium sempervirens* contains an organic acid, *gelseminic acid*, and a nitrogenised alkaloid, *gelsemine*, to the latter of which the plant owes its activity. (See *Year-Book of Pharmacy*, 1876, 194–197.)

The method there pointed out for the preparation of these two principles was to concentrate the fluid extract of the root (containing the soluble matter of 480 grains of the root to the fluid ounce) to about one-eighth its volume, dilute the concentrated extract with several times its volume of water, and after subsidence of the resinous matter and filtration, to again concentrate the liquid to the original volume of the extract employed. The liquid was then acidulated with hydrochloric acid, and the gelseminic acid extracted with ether, after which the liquid was rendered alkaline, and the gelsemine extracted by chloroform.

More recent investigations have shown that by the former part of this process a large proportion of both the principles in question are separated with the resinous matter, and thus escape recovery. After trying various methods for the more complete recovery of these principles from the fluid extract, the author finds the following to give the best results. A given volume of the fluid extract, acidulated with acetic acid, is slowly added, with constant stirring, to about eight volumes of water; after the separated resinous matter has completely deposited, the liquid is filtered, and the filtrate concentrated on a water bath to something less than the volume of fluid extract employed. The gelseminic acid is then extracted from the concentrated fluid by ether, after which the liquid is treated with slight excess of carbonate of sodium, and the gelsemine extracted with ether or chloroform. For the extraction of the first of these principles it is not essential that the liquid should be acidulated, but in the presence of a free acid the results are more satisfactory.

A series of examinations of a number of samples of the fluid extract of gelsemium, prepared by several of the more prominent manufacturers, showed that, as found in commerce, it quite uniformly contains about 0·2 per cent. of gelsemine, and 0·4 per cent. of the non-nitrogenised principle. The only marked exception to this was found in the case of a fluid extract furnished a physician as a sample, which contained just double the ordinary proportion of the alkaloid and acid. Two samples of fluid extract, prepared by the same firm, as obtained from the shops, contained the ordinary quantity of the alkaloid and acid. Within the last few years, thirteen cases of poisoning by the preparation of gelsemium, have been reported, nine of which proved fatal. In the fatal cases the dose of the fluid extract varied, in the case of adults, from about one fluid dram to one tablespoonful; and the time of death from two hours and a half to seven hours and a half. In one instance 15 grains of the resinoid "gelsemin," proved fatal to a woman in one hour after the dose had been taken.

Fifty minims of a tincture prepared from four ounces of the root to one pint of dilute alcohol, proved fatal to a child aged three years in two hours. And in another instance a much less quantity of the tincture, taken in two doses, caused the death of a child in one hour after the second dose had been taken.

In one of the non-fatal cases a tablespoonful of the fluid extract had been taken; but it was soon followed by vomiting, induced by an emetic.

In another instance, in which from one to two teaspoonfuls of the ordinary fluid extract produced most profound symptoms, recovery took place under the administration of three grains or more of morphia, employed hypodermically, in half-grain doses, repeated every few minutes. From the report of this case by Dr. Geo. S. Courtwright (*Cincinnati Lancet and Observer*, Nov., 1876), it would appear that the morphia was the means of saving the life of the individual.

In the cases thus far reported there seems to be only one, or at most two, instances in which the poison was administered with criminal intent.

The Active Principles of Calabar Bean. (*Pharm. Zeit.*, 1877, Nos., 16, 30; *New Remedies*, June, 1877, 163.) There is scarcely another modern drug which has been subjected to such frequent and exhaustive investigations as the seeds of *Physostigma venenosum;* but at the same time there is a surprising difference of views and theories in regard to its physiological action. All authors are agreed on *one* property of the drug, namely, that of contracting the pupil, but in all other respects they differ widely. Ever since Fraser's classical investigations (1863), it has been customary to regard the calabar bean as a poison directly paralysing the spinal cord, and from this view arose its employment as a remedy in tetanus, where it was found (by Watson and others) to be so exceedingly effective that most other previously-used remedies were henceforth discarded. But lately statements have been published, in reference to the action of the commercial extract of calabar and of "physostigmin," which would make their usefulness in tetanus appear exceedingly problematical. Rossbach and Nothnagel, for instance, assert that extract of calabar is not a paralyzing but a tetanizing poison; and the latter adds that it resembled strychnia, in so far as its paralysing effect was a secondary symptom depending upon an exhaustion of nerves and muscles, by preceding violent convulsions. Martin Damourette thought he had solved the problem by supposing that the drug excited the spinal marrow, and paralysed the peripheral nerves. But such compromises, unsupported by evidence, are inadmissible in exact science, and Rossbach was unable to obtain any paralysing effects upon the peripheral nerves with Merck's physostigmin. It was left to chemistry to throw light upon these apparent discrepancies. Hitherto it had been supposed that calabar contained only *one* alkaloid, namely, physostigmia, as Hesse called it, or eserina, as Vé and Leven termed it. But, according to the researches of Harnack and Witkowsky, conducted in the pharmacological laboratory at Strassbourg, calabar bean contains *two* alkaloids, one of which entirely resembles strychnia in its effects, while the other produces the previously known central paralysis. The new alkaloid, named by the discoverers calabarin (calabaria), differs from physostigmia by its insolubility in ether, and easier solubility in water; it is also soluble in alcohol. A further difference is the fact that the precipitate produced by potassium iodohydrargyrate in calabarin solutions is insoluble in alcohol. The commercial preparations of calabar are, according to the same authorities, mixtures of the two alkaloids in varying proportions, and therefore produce such discordant effects. Whenever physostigmia preponderates, it appears to suppress the effects of calabarin. This fact explains why most investigators merely took notice of the paralysing effects. On the other hand, there are preparations in the market which scarcely contain any physostigma at all, as was proved directly by Harnack and Witkowsky in the case of an English specimen. The purest commercial preparation was Duquesnel's eserine, which appears to be absolutely free from calabarin. Since, therefore, commercial preparations of calabar may contain comparatively large per centages of calabarin, the administration of which is positively injurious and highly dangerous in tetanus, it is desirable to possess a means of control, or to employ preparations which make the presence of the dangerous alkaloid impossible. As the latter is absolutely insoluble in ether, it appears advisable to introduce, in place of the present officinal alcoholic extract of calabar, an ethereal extract, although the same drawback, which Hager points out as inhering to the officinal preparation, is not unlikely to attach to this, namely, a process to speedy deterioration. Indeed, physostigmia is very readily decomposed with formation of Duquesnel's rubeserin, which appears to be formed not only under the influence of alkalies, but even spontaneously, as may be suspected from the change of colour observable in old calabar beans. Duquesnel's eserine has an especial tendency towards this decomposition, according to Harnack and Witkowsky. But rubeserin cannot contaminate the ethereal extract prepared from the beans, since it is insoluble in ether.

In No. 21 of the same serial we find a communication by O. Hesse, commenting on the above article, in which he states that he has succeeded in extracting from calabar beans a substance crystallizing from alcohol in probably the same form as the so-called crystallized eserine, and appearing to be a much more definite and stable substance than the latter. It crystallizes from ether, chloroform, and petroleum ether in white silky needles, melts at 133–134° C., is indifferent, and greatly resembles cholesterin and isocholesterin in appearance, though not in properties or composition. Hesse also adds that the substitution of an ethereal instead of an alcoholic extract would be of but little use, as calabar beans contain physostigmia in such a combination that it appears insoluble in and incapable of extraction by pure ether.

The well-known manufacturing chemist, E. Merck, in Darmstadt, has heretofore prepared and sold a substance which was supposed to be the only active principle of calabar, and which he called calabarin, but which was really eserine or physostigmin. He now accepts and confirms the results of Harnack's and Witkowsky's researches; and has introduced both of the active principles into the market labelled with their correct names, namely, *physostigmin* (or eserine, being the same substance which he formerly sold as calabarin), and *calabarin*, distinguished by the addition of Harnack's name ("Harnack's Calabarin.") *The attention of physicians and pharmacists is particularly directed to this change of appellations.*

Carobæ Folia. Dr. A. Alt. (*Pharmaceut. Zeitung*, 1877, 289.) The author's attention was directed to this drug by Mr. C. Weber, whose long experience as an apothecary at Rio de Janeiro and Monte Video had made him familiar with its valuable therapeutic properties. It is used in Brazil as a diaphoretic, diuretic, and tonic; but chiefly and most successfully as an alterative in the various forms of syphilis. The author has tried it extensively, and expresses himself much pleased with the results, especially in old standing cases of syphilitic eruptions, and after a course of mercurial treatment.

The drug is known under the name "Caroba" in Brazilian commerce, and has hitherto met with little attention in Europe. It consists of long ovate leaflets, which are dark green on the upper and pale green on the lower surface, and have very conspicuous lateral veins. Its botanical source, according to Sprengel, is *Jacaranda procera*, a tree belonging to the family *Bignoniaceæ*, and growing to a height of thirty to forty feet. Its root is dark red externally, and whitish yellow internally; its stem is much branched, and densely covered with unequally pinnate leaves. The flowers vary in colour between white and red, and emit a pleasant, honey-like odour; the fruit is a two-celled woody capsule. The drug was introduced to the notice of European practitioners by Dr. Joan Alves de Carneiro, who placed it before the Medical Academy of Paris. The experiments conducted with it by Carron de Villards, Bompani, Souto, Barros Pimental, Level, Spicks, and Martin, the last named of whom called the plant "*Cybistas antisyphilitica*," proved very successful. A decoction of the leaves is much used by the natives as a stomachic tonic and for improving the appetite. In syphilis and in skin diseases the drug is employed both internally and externally. The preparations generally used are the decoction and the powdered leaves. The author recommends a liquid hydro-alcoholic extract containing three to four per cent. of dry extract.

Timbo. M. Martin. (*New Remedies*, from *Bull. Gen. de Therap.*) Plants belonging to the *Sapindaceæ*, the same to which *Paullinia sorbilis* (the botanical source of guarano) belongs, are very common in Brazil, and comprise both trees and climbing shrubs. Some have such poisonous properties that the natives use their juices as arrow-poisons, while others are innocuous or simply narcotic. The timbo (*Paullinia pinnata*, Lin.) belongs to the latter class. The timbo is a tree found in Brazil, Mexico, the Antilles, and in Guiana. The leaves are composed of five leaflets, oval, lanceolate, and crenulated. The flowers are polygamous, diœcious, and have five, or rarely four parts; an imbricate calyx; four unequal petals furnished with scaly appendices; eight stamens situated around a disc with notched edges; ovary with three cells, surmounted with three styles, and containing three seeds, and commonly one which has aborted, which is provided with an arillus and contains under its envelope an embryo without albumen. The bark of the timbo root is the only part used in Brazil; it is of a yellowish grey colour, and variable in length and thickness. In transverse sections there is observed from outside inwards: (1) An exterior layer of periderm, composed of numerous masses of corky or woody tissue; (2) on reaching the central parenchyma, there are seen here and there small masses of hardened cells (that is to say, having early incrustations),—this element is frequent in the bark and in this situation; (3) a very thick layer of cortical parenchyma, in which the cells are distended with starch; (4) in the midst of this parenchyma cells containing a resinous material; (5) bundles of liber arranged in interrupted lines and mixed with rays of the medulla. This bark is without difficulty reduced to powder. Five grams of it will absorb, cold, fifteen grams of distilled water.

The bark of timbo root has an agreeable aromatic odour, slightly resembling musk. In Brazil it is only employed externally. Poultices are made from it with boiling water, which are applied to the side in affections of the liver. It often causes intense eruptions, in which case the application is discontinued.

M. Martin has isolated from the root-bark starch, resin, an essential oil, chlorophyll, tannin, an organic acid, traces of glucose, and an alkaloid to which he gives the name of "timbonine."

By first treating the finely powered bark by carbon disulphide, the extraction of the alkaloid and other principles is facilitated. The sulphate of timbonine crystallizes in white needles.

Note on a Piper Jaborandi from Rio Janeiro. Dr. A. Gubler. (*Journ. de Pharm. et de Chim.* [4], xxv., 128; *Pharmaceut. Journ.*

3rd series, vii., 731.) Besides the jaborandi of Dr. Coutinho (*Pilocarpus pennatifolius*), the sialogogue and sudorific properties of which are so remarkable, there exists in Brazil, as is known, a large number of plants bearing the same popular name, which are used against the bites of serpents, etc. All the botanical species, however, are included in two families, *Rutaceæ* and *Piperaceæ*. Among the latter, *Piper citrifolium* and *P. reticulatum* have been mentioned as particularly efficacious. A jaborandi from the province of Rio Janeiro, which has been the subject of a note in the *Journal de Thérapeutique*, for November 25th, by Professor Gubler, appears to be referable to either of these species, which perhaps should be combined in one.

The plant is a shrub, usually attaining, but sometimes considerably exceeding, a metre in height. The stems are fasciculated at the base, simple, and denuded for half their length, cylindrical, very straight, and articulated like the bamboo; towards the top they bear dark green leaves that are alternate, shortly petiolate, oval-lanceolate or slightly obtuse. In the axils of these are sometimes found catkins of male flowers. A supply of the plant collected by Dr. da Veiga, of the Brazilian navy, has been investigated chemically, physiologically, and therapeutically.

According to Professor Gubler the entire plant exhales a slightly aromatic odour, which becomes more pronounced upon bruising the leaves between the fingers. When chewed the taste is at first slightly acid, then warm and aromatic, and finally very piquant, and comparable to that of pyrethrum root. This taste is met with in the stems and especially in the roots, where it attains a high degree of intensity, chiefly in the moderately large portions, about the size of a crow quill, which are externally of a rather decided grey colour. The more slender and whitish portions are rather insipid, and the finest have hardly any taste at all. These differences are dependent upon the constitution and thickness of the cortical layer, which appears to be the seat of the active principle.

When a picked fragment of the root is chewed, at first no sensation is produced on the palate; the prickling is first manifested at a short interval after the vegetable tissue becomes impregnated with saliva. It would appear that the active principle of the drug does not exist ready formed in the plant, but is due to a special fermentation in the presence of water, similar to that which sets free oil of bitter almonds or oil of mustard. When once manifested the piquancy rapidly acquires great energy, being accompanied by painful shootings and vibratory tremblings of the tongue and lips, as though these organs were traversed by an electric discharge. At the same time a very active secretion of all the buccal glands becomes developed, and especially an extraordinarily abundant salivation. These phenomena persist for a few moments after the sapid pulp has been rejected, but then decrease and disappear, leaving a sensation of freshness and a certain degree of anæsthesia of the palate. After a few minutes, however, all the parts return to their normal state.

Upon swallowing the saliva charged with the active principle, an impression of heat is produced at the back of the throat, which extends to the œsophagus and stomach, where it gives rise to a sensation resembling hunger.

The chemical composition has been studied by M. Hardy, who in some preliminary experiments with infusions was able to demonstrate the presence of an alkaloid.

Some leaves and stalks were therefore powdered and left to macerate for four days with three times their weight of 90° alcohol, acidulated with eight grams of hydrochloric acid per litre. The alcohol was then decanted and fresh alcohol added, and this was repeated three times. The alcoholic solutions were concentrated by distillation, and the aqueous solution evaporated and decomposed by ammonia in the presence of excess of chloroform. Upon evaporation of the chloroform the base was left free, but still impure. It was therefore treated with water acidulated with hydrochloric acid, which dissolved the major part of it; the solution was filtered, evaporated, and again decomposed by ammonia in the presence of excess of chloroform. Upon evaporation of the chloroform solution the base was deposited, having a crystalline appearance and slightly yellowish tint.

The base presents the characteristic reaction of alkaloids; its solution gives a white precipitate with iodide of mercury and potassium, and with iodine in iodide of potassium. Another portion of the leaves was distilled with water to obtain the volatile oil, but only a small quantity was collected, insufficient for investigation.

The alkaloid dissolved easily in water slightly acidulated with hydrochloric acid, and such a solution was used by Dr. Bochefontaine to study its physiological action upon animals. He found that it did not act upon the heart, or influence the muscular contractility; it was not a convulsivant. It appeared to have the power to prevent the mechanical or electric excitations of the mixed nerves, such as the sciatic, from being transmitted to the muscles. It appeared even to possess the paralysing power at the outset, and this property would seem to distinguish it from curare. Indeed, the paralysing action of curare is usually preceded by some slight spasmodic movements, which have not been observed in frogs poisoned with the alkaloid of false jaborandi.

Professor Gubler remarks that the effects observed after the administration of the plant to the human subject, although in small doses, had not led him to expect so violent an action from the alkaloid of the Rio piper. The first experiment, in 1875, with the comparatively fresh plant, did not reveal any great activity compared with the excessive power of *Pilocarpus pennatifolius*. Besides the peppery sensation on the mouth and throat, and the heat in the stomach, doses of four to six grams of the leaves in infusion only caused slight salivation and diaphoresis. More recent experiments have been still less fruitful. In a case of acute albuminous nephritis its effects were absolutely *nil*; whilst in the same patient on the following day an infusion of four grams of *Pilocarpus* jaborandi in 200 grams of water caused abundant salivation and sweating, and an increased excretion of urine.

From these negative facts Professor Gubler draws the following conclusions:—

1. That there exists a striking difference between the mode of action of *Pilocarpus pennatifolius* and of *Piper reticulatum*. With an insignificant topical action, the *Pilocarpus* manifests a diffused action of great energy; the second, though very aggressive to the organs at the entrance to the *primæ viæ*, appears to be nearly inert when it once enters the circulation.

2. That this inertia of the *Piper* is more apparent than real, and due to the insufficiency of the doses employed. In future it will be desirable to administer larger doses of the leaves, or better still of the root, to obtain physiological effects.

But if the alkaloid discovered by M. Hardy is a certain test of the efficiency of the *Piper reticulatum*, the experiments of M. Bochefontaine show that it will be advisable not to seek to obtain the first manifestations through the secretions, as the new agent is a poison of the motor system closely allied to curare.

Resina Guaiaci Peruviana Aromatica vel Odorata. A. Kopp. (*Archiv der Pharmacie*, Sept., 1876.) Some time ago the firm of Gehe & Co. purchased a resin in Paris which they have since been selling to perfumers, and the origin of which could not be ascertained. It is entirely different from true guaiac resin, yields in distillation with water about 4 per cent. of volatile oil, having an odour resembling a mixture of peppermint and citron, and yields in dry distillation various oils of different boiling points, which exhibit very peculiar colours. The portions distilling below 210° C. were brownish yellow to brown, strongly dichroic, and became green with ferric chloride. Addition of aqueous ammonia or soda turns them deep red, the ammonia-water itself becomes red, and on neutralization with an acid changes to blue. The portion boiling between 255° and 270° distils over of a pure and deep azure colour, resembling ammonio-cupric solutions. This is probably identical with the blue oil of matricaria and galbanum.

Tayuyá. (*Pharm. Centralhalle*, 1877, 211.) A previous notice of this drug will be found in the *Year-Book of Pharmacy*, 1876, 167.

Tayuyá or tayuiá, is the name of a vegetable drug which has been employed for a very long time by the natives and physicians of Brazil, as a remedy in various diseases. *Tayuia de abobrinha*, or *abobra*, is the common name of the plant in question, which is *Dermophylla pendulina*, Manso, nat. fam. Cucurbitaceæ-Bryonieæ, and whose synonyms are *Brianosperma ficifolia*, Mart., *Bryonia ficifolia*, Lam., *Bryonia tayuyá*, Velloso. The root is the most active portion. It is said to be a most valuable remedy in malarious fevers, dropsy, syphilis, mental disorders, elephantiasis, skin diseases, etc. It has also been used with tolerable success externally, in form of a lotion, particularly in an affection common to Brazil, namely an inflammation of the sphincter ani (bicho do cû), according to Rosenthal, in his "Synopsis Plantarum."

Stanislaus Martin states (in *L'Union Pharm.*) that he had received specimens of the root in slices 5 c.m. (2 inches) broad and 2–3 mm. (about ¼ inch) long. According to Martin's description, it does not seem to be much different from that of the European Bryonia root. He extracted from it a green resin (tayuyin); a citron-yellow fat, and brown extractive matter, both of very bitter, aromatic taste; tannin, pectin, traces of glucose, starch, and volatile oil; and he found the ash to contain magnesia, lime, alumina, potassa, and iron. He could find no alkaloid in it. Prof. Luigi Gabba, of Milan, extracted the root with alcohol, and obtained by evaporation a brown extract, of neither acid nor alkaline reaction, very stable, and drying up to an amorphous mass, which was only partially soluble in cold, but more so in boiling water. The latter solution, mixed with dilute sulphuric acid and heated, did not exhibit any remarkable change, but gave indications of glucose. As this reaction failed to make its appearance before the addition of the acid, Gabba concluded that the root contained a glucoside. Prof. Zenoni states, that on exhausting the root with ether and then treating it with acidified alcohol, he obtained a substance which appeared to give him the reactions of an alkaloid. Yvon, who subjected Martin's investigation to a control, found in it a wax-like resin, soluble in ether and chloroform, of acid reaction, greenish yellow colour, and very bitter taste. Its melting-point is said to be at 49° C. (120° F.), and its solution in alkalies or ammonia developed microscopic crystals. This resin is said to be the active portion. An alcoholic tincture of the root deposited, after concentration, a small quantity of prismatic crystals, but they were devoid of alkaloidal properties.

The explorer Luigi Ubicini brought the root to Europe, and caused a strong tincture to be prepared from it, of the strength of 1 part dry root to 3 parts of 80 per cent. alcohol. This was directed to be diluted with 3 times its weight of dilute alcohol before using, and this diluted tincture is used internally, as *Tinctura Dermophyllæ diluta*, in doses of 2 to 12 drops, 3 to 4 times a day. The *daily* dose should not exceed 24 drops. For external use in syphilitic or scrofulous skin diseases, it is to be diluted with twenty or thirty times its weight of water; although it may be used in concentrated form upon indurated glands. For hypodermic use 0·3–0·5 gram of the tincture are to be diluted with water to 1 gram, which constitutes one dose.

Note on Dickamali Resin. Professor Flückiger. (*Pharm. Journ.* 3rd series, vii. 589.) This substance, the resinous exudation of *Gardenia lucida*, Roxb., *Rubiaceæ*, is much used in India, both internally and externally. It contains, according to Stenhouse, a crystallizable resin, described by this chemist "as one of the most beautiful substances of that kind." It has a marked, peculiar odour, somewhat resembling rue and aloes; it looks crystalline and has a yellowish colour, being decidedly yellow when powdered; the solution has a fine yellow colour with a greenish hue. It assumes an intensely greenish brown colour on addition of ferric chloride, and on addition of a little soda it turns brown. It belongs to the *aromatic* class of organic compounds, as it yields, by fusing with caustic potassa, protocatechuic acid.

Indian Hemp and its Active Principle. (*Pharm. Zeit. für Russ.*, 1876, 705; *New Remedies*, March, 1877.) The home of hemp is Persia and the high plateau of northern India, whence it has gradually spread to other countries, so as to be domesticated everywhere. Its narcotic properties, however, are only developed fully in its native home in Asia, and in certain parts of Africa, where it is used as a narcotic stimulant and intoxicant by nearly 300,000,000 of inhabitants.

A preparation, called madjoun, is sold in Algiers, which is powdered *Cannabis sativa* boiled with honey for a longer or shorter time, according to the desired consistence. Usually it is kept mixed with a certain portion of *ras-el-hanout*, a spice compound containing nutmeg, cinnamon, cloves, various peppers, ginger, galangale, and Guinea grains. This mixture is also called *kif*. The dose varies from the size of a hazel nut to that of a walnut, according to the age, sex, and tolerance of the person using it. Most eaters of hashish also smoke the dried leaves of the plant, either alone or mixed with the so-called "tobacco of the desert," which, according to Dr. Guyon, is a species of hyoscyamus.

Dr. Preobraschensky, who accompanied the expedition to Chiwa in 1873, furnishes the following information on the hashish of Central Asia:—"This article occurs in the bazaars of large cities of Middle Asia in the form of plates or cakes of various shapes, mostly five to fifteen inches long, five to ten inches broad, and one to three inches thick; externally they are dark brown, internally greenish or brownish, of firm consistence, very tough, and almost incapable of being broken, but easily cut into fine shavings. They are prepared as follows: The resinous juice from the fresh unripe flower-tops is collected during spring, mixed with sand and water to a doughy mass, which is spread upon a surface of clay, and dried until it can be cut with a knife into plates. In a few days more the excess of water has evaporated and the substance is ready for use. It is called hashish by the Russians, nascha by the natives, bang and gunjah by the Persians, and is exported from Bochara to Chiwa, Tashkend, Kokant (Chokand), and other places.

The active principle of hashish has been supposed to be resin. Dr. Preobraschensky has, however, lately subjected hashish to a chemical analysis, and has found an alkaloidal body not only in the commercial substance, but also in the flower-tops of hemp itself, and the pure extract prepared from it, which was recognised as *nicotine*. 150 grams of the herb, distilled with water, furnished 25·4 milligrams of nicotine; 50 grams of the herb, distilled with caustic lime and potassa, yielded 335·28 milligrams; 5 grams of the extract of *Cannabis indica*, dissolved in alchohol and distilled, yielded a distillate containing 91·14 milligrams of nicotine; and 2 grams of the extract, distilled with caustic lime and potassa, furnished 63·5 milligrams of the same alkaloid.

Notes on the Genus Teucrium. J. M. Maisch. (*Amer. Journ. Pharm.*, Sept., 1876.) *Teucrium scordium*, Lin., *germandrée aquatique* of the French, *Lachenknoblauch* of the Germans, is usually called water germander in English, because it grows in moist, swampy meadows, near ponds, etc. It is found in western Asia, and throughout a large portion of Europe. Forty years ago it was officinal in most pharmacopœias of continental Europe, but since then has been dismissed in the revised editions of nearly all, retaining a place in a few only.

The plant belongs to the natural order of *Labiatæ*, a family of plants which is characterized by the complete absence of deleterious properties, the active constituents found in them being chiefly volatile oil, associated in many with more or less of a bitter, non-alkaloidal principle, and occasionally with a little tannin. The medical properties of the *Labiatæ* are therefore mainly carminative and stimulant, and frequently tonic and stomachic. They are mostly indigenous to the temperate regions of the old world, the number indigenous to the United States being comparatively small; but many species have been introduced here from Europe, and completely naturalized in some sections of the United States.

The genus *Teucrium* is classed with the tribe *Ajugoideæ*, which has the upper lip short, or deeply notched and turned forward, so as to appear wanting, the four ascending stamens projecting through the slit in the upper lip. Several of the European species formerly enjoyed a high reputation, among them the one mentioned, which, together with the allied species, *T. scordioides*, Schreb., is regarded to be the Σκόρδιον of Dioscorides. The plant is softly pubescent, attains a height of twelve to eighteen inches, has sessile, oblong, serrate leaves, and rose-coloured flowers, two or three of which are found in the axils of the leaves. The second species differs mainly by being villous, and having cordately ovate, somewhat clasping, leaves. Both possess a bitter taste, and, in the fresh state, a distinctly alliaceous odour. It was formerly in repute as an antiseptic and diaphoretic internal remedy, for gargles, and as a dressing for foul ulcers. "The New London Dispensatory," printed in 1676, says of it:—"It is lyptintick, abstersive, traumatic, alexipharmick, sudorific, anodyne, and pectoral; it opens obstructions of all the principal parts, cleanseth the entrails and old ulcers; provokes urine and the terms; expectorates rotten matter out of the chest; helps old coughs, asthma, pleurisies, inward ruptures, biting and stinging of serpents; and potently resists poison, plague, and all pestilential diseases. It exhilarates the heart, cures the bloody flux, comforts the stomach, and drives out the small-pox and measles. Outwardly, it cleanseth and heals wounds and ulcers, and cures pain of the gout. The essence is most effectual to the intentions aforesaid."

Similar but more feeble virtues were attributed to *T. scorodomia*, Lin. (syn. *Scorodina veteromalla*, Moench), likewise a European plant, which differs from the former in having petiolate, cordate-ovate leaves, a more distinctly two-lipped calyx, and yellow corolla.

The fluid extract of water germander may be made by the U. S. officinal process for fluid extract of chimaphila, and may be given in doses of one-half to one teaspoonful.

The following European species were formerly employed medicinally for their stimulating and tonic properties, and some still enjoy some popularity as domestic remedies in localities where they occur:—

T. polium, Lin., with sessile, linear-lanceolate, crenate and tomentose leaves, and terminal white flowers.

T. montanum, Lin., leaves similar, with a revolute margin and terminal yellowish flowers.

T. creticum, Lin., resembling the preceding, but the bluish flowers axillary and single. The closely allied *T. rosmarinifolium*, Lam., has the branches longer and more slender, and the flowers in cynules of three in the axils of the bracts.

T. flavium, Lin., has its greyish yellow flowers similarly arranged, but the petiolate leaves are ovate and crenate.

T. fructicans, Lin., is the *erba di S. Lorenzo* of southern Italy, and has entire, oblong or oval sub-coriaceous leaves, and single axillary flowers with bluish corolla.

T. chamædrys, Lin., the χαμαίδρυς of Discorides; leaves short petiolate, ovate to obovate, cuneate at base, crenately serrate; flowers, one to three, axillary, with purplish red corollas.

T. botrys, Lin., leaves triangular-ovate in outline, pinnatifid; flowers axillary, in threes; corolla pale red, punctate in the throat.

These, and a few other species, indigenous to southern Europe and the basin of the Mediterranean, most probably do not differ in their medicinal properties from *Teucrium Canadense*, Lin., the wood-sage or germander of the United States and Canada.

Somewhat different properties are met with in *T. marum*, Lin., cat thyme, or Syrian herb mastich, which is found in the countries bordering on the Mediterranean. Its leaves are petiolate, ovate or ovate-oblong, rather acute, white tomentose beneath; the rose red flowers are single in the axils of the bracts, and form a terminal one-sided raceme. It has a strong aromatic, somewhat camphoraceous odour, and an aromatic, bitterish and acrid taste. It has been employed internally in doses of twenty to sixty grains, in various spasmodic and other nervous disorders, and externally chiefly for its errhine properties. It constituted the active ingredient of the *Pulvis sternutatorius* of some old European pharmacopœias, which was composed of sweet marjoram, 3 parts; cat thyme, lily of the valley, and orris root, of each 1 part. Cat thyme is prescribed in Europe under the name of *Herba mari veri.*

Tannin in Gentian Root. M. Ville. (*Répert. de Pharm.*) Since the presence of tannic acid in gentian root asserted by Mr. E. L. Patch in a paper read before the Massachusetts College of Pharmacy has been disputed by Prof. Maisch (see *Year-Book of Pharmacy*, 1876, 228), the author has been induced by Prof. Leon Soubeiran to reinvestigate this subject. In the course of his experiments with cold infusions of the roots of *Gentiana Burseri* and *Gentiana lutea* he obtained unmistakable indications of the presence of tannin with ferric chloride, gelatin, and albumen. He also observed that in decolorizing the cold infusion with animal charcoal the colourless filtrate was free from bitterness, and ceased to give indications of tannin with the reagents named. Further experiments were then made with the view of ascertaining whether the tannin found formed part of the colouring matter or of the bitter principle of the root. The results of these experiments prove the absence of tannin in the latter, but seem to establish the tanning nature of gentianin, the colouring principle of gentian root. In consideration of the chemical properties of the colouring matter, the author suggests that gentianin should in future be called gentiano-tannic acid. In his opinion there is much analogy, from a chemical point of view, between gentianin and the colouring matter of rhatany root.

The Constituents of Cotton Root Bark. C. C. Drueding. (*Amer. Journ. Pharm.*, 1877, 386.) The constituents isolated by the author are a red and a yellow resinous colouring matter, a fatty oil, gum, glucose, tannin, chlorophyll, and 6 per cent. of mineral matter.

Chicle Gum and Monesia Bark. J. R. Jackson. (*Pharm. Journ.*, 3rd series, vii., 409.) So long ago as 1839 an article was published in the Paris *Medical Gazette* on a vegetable substance known as monesia. This article was reprinted in the *Pharmaceutical Journal*, vol. iii. (1843–44), p. 292. It pointed out that *monesia*, as then known, was in the form of hard, thick cakes, covered with yellow paper, each weighing about 500 grams; and in this form it was, at the date given above, a recent introduction into France. The substance consisted of an extract prepared from the bark of the tree, the botanical source of which was at that time unknown, though it was supposed to be a species of *Chrysophyllum*. It was known, however, to travellers as *goharem* or *buranhem.* The bark was described as smooth and greyish, in appearance like that of the plane tree, but much thicker, showing an imbricated fracture and having a sweet taste. The extract was in colour a deep brown, very friable, and when broken having the appearance of a well roasted cocoa-nut; entirely soluble in water; at first sweetish to the taste, like liquorice, but afterwards becoming astringent, leaving a well marked and lasting acid taste in the mouth, which is particularly felt in the tonsils. The ailments in which monesia was administered were diarrhœa, leucorrhœa, uterine hemorrhage, inflammation of the mucous membrane, etc. Such is a brief *résumé* of what has been already published on monesia, which will be found in detail at the reference given above, as well as at pp. 125, 187, vol. iv. (1844–45), of the *Pharmaceutical Journal*, the latter being a quotation from the "Systema Materiæ Medicæ Vegetabilis Braziliensis." In this the plant is referred to as the *Chrysophyllum buranhem* of Riedel.

Quite recently the plant has been brought to notice again, as "chicle," in New York, whence it is imported from Mexico for manufacturing purposes, such as mixing with rubber for insulating telegraph cables. Some experiments have also been made with it with a view of manufacturing a paint for the bottoms of vessels; beside which an essential oil, adapted for perfumery purposes can, it is said, be extracted from it. A specimen of this chicle gum has recently been received at the Kew Museum. In appearance it is somewhat like crude gutta-percha, but more friable or brittle. It it easily made plastic in warm water; but from experiments made in this country it does not seem suitable for mixing with india-rubber for telegraphic purposes, as it makes the rubber itself more brittle. Besides the name of chicle, the substance seems to be known in the New York market as "Mexican gum" and "rubber juice." The identification of this gum with the plant yielding monesia is founded as yet only on the fact that the plant yielding the former is known as zapota or zapote, and is described as a saponaceous tree; and further, that it yields a medicinal product known as monesia. Specimens of the plant itself have not yet been received; therefore, though all the circumstances indicate them to be one and the same thing, it cannot be decided as a certainty until the reception of actual specimens yielding chicle gum.

With regard to the curanhem or guaranhem of Brazil, which is also known as the imiracem, mohica, and cusca doce (sweet bark), it is conclusive that the plant furnishing them is the *Chrysophyllum glycophlœum*, Gazar. (*C. buranhem*, Riedel). It is one of the commonest trees in Brazil, and is met with even in the environs of Rio de Janeiro, where Cazareth studied it (on the Corcavado), as well as Velloso and Peckholt in Cantagallo. Both in the provinces of the north as well as in the Antilles, it is well known and employed in medicine and in veterinary practice. The bark is carried to market in fragments of from two to three millimetres thick, and five to twenty centimetres in length. It is of red or brownish colour, according to the season in which it is gathered, and according to the age of the plant. When recently collected, the bark is abundantly milky, and has a strong astringent and sweetish taste.

Monesia as now met with presents under the form of transparent plates of a yellowish white colour a substance easily pulverized. When reduced to powder it has a white colour. It is soluble in alcohol and in water, but barely so in sulphuric acid. When put into water and shaken it produces a froth like soap-suds. In Brazil the preparations of the bark of this plant are used both internally and externally. It is considered an excellent astringent, applied in the same cases as the ratanhia. In Bahia, Leigipe, and sundry other provinces, it is the usual medicine for cases where an energetic astringent is required. The preparations employed are, the decoctions for baths and clysters; the extract for pills and to put on cataplasms; and the syrup or wine. The disorders in which this medicine is most efficacious are diarrhœa, intermittent fevers, dysentery, hemorrhage, ulcerations of the gastro-intestinal canal, quinsy, etc.

With regard to the physiological action of monesia, it is said that, notwithstanding its sweetish taste, it belongs strictly to the astringents and tonics. Its astringency becomes less sensible by the presence of the saccharine principle contained in the bark. On ulcers it produces a sensation of pain, accompanied with great heat, which lasts for hours, and sometimes even for days, afterwards accompanied with a rapid formation of numerous fleshy pimples. On the fibres of the uterus it acts with the same effect as ergot of rye.

Monesine, the acrid principle, is applied in doses of 1 to 3 decigrams. The syrup has a great reputation against hæmoptysis, the extract in ulcerations of the mouth and the gastro-intestinal canal, as has already been said. Externally the extract, either with glycerin or pure, is considered very efficacious for wounded breasts, lips, and arms; the powder is also used for similar purposes. With regard to the industrial applications of the bark of *Lucuma glycyphlœum*, it is, on account of its astringency, used both for tanning leather and for dyeing purposes; further than this, it is said to contain a quantity of saponaceous matter which might be employed for cleaning, but which does not seem capable of development to any extent so as to make it commercially profitable.

The foregoing remarks on the products of *Lucuma glycyphlæum*, or monesia, are abstracted from a report recently drawn up for the Brazilian Government by some of the best authorities on the subject. Although monesia is not now used in Brazil so much as formerly, it still has a reputation.

Examination of the Rhizome of Iris Versicolor. C. H. Marquardt. (Abstract from an inaugural essay: *Amer. Journ. Pharm.*, 1876, 406.)

Eight troy ounces of the rhizome, in moderately fine powder, was exhausted by alcohol, sp. gr. ·835, and the alcohol distilled off. The residue had a very acrid taste, and separated into an upper, dark brown, perfectly transparent layer, and a lower one of a more yellowish colour; the former was soluble in alcohol, petroleum benzine, chloroform, and ether; the latter dissolved completely in alcohol, partly in ether, and not in chloroform or benzine. The entire residue was exhausted with the ether, and the solvent evaporated, leaving a dark brown oleo-resin, of a slightly disagreeable odour and a very acrid, persistent taste. Ammonia water dissolved a small portion of it, but effected no separation. Treated with cold solution of potash, a yellowish white emulsion was formed, from which an *oily liquid* separated, which was purified by dissolving in ether, and had then a light colour and a pleasant bland taste, which after awhile became acrid.

The potash solution was carefully neutralized with sulphuric acid, concentrated by evaporation, and treated with ether, which dissolved a brown, *soft resin*, possessing the acrid taste in a very marked degree, and yielding with nitric acid a beautiful purple coloured mass, becoming yellow and tough after some hours.

The residue left by treating the alcoholic extract with ether was of a yellow colour, had a sweet taste, was soluble in water and alcohol, and by Trommer's test proved to be *glucose*.

The dregs, exhausted by alcohol, were extracted with diluted alcohol, sp. gr. ·941; the light yellow tincture was evaporated to a syrupy consistence and set aside for a week, when a sweet, solid mass remained. Its solution in water was precipitated by subacetate of lead, and after removing the excess of lead by sulphuretted hydrogen, Trommer's test indicated in the filtrate the presence of *glucose*.

The precipitate on being suspended in warm water and treated with sulphuretted hydrogen, yielded, on evaporating the water, a *yellow mass*, having a peculiar, not unpleasant, bitter taste.

The exhausted powder yielded to cold water some *albumen*, separable by heat, and *gummy matter*, precipitated by alcohol, and the solution of which formed a jelly with ferric chloride. Hot water dissolved mainly *starch* from the exhausted powder.

On distilling the fresh rhizome with water, an opalescent distillate, of a peculiar odour, was obtained, from which a white *camphoraceous* substance separated, scaly in appearance, of a faint odour, nearly tasteless, and soluble in alcohol.

The Detection of Admixtures in Colocynth Powder. Wm. J. Clark. (Abstract of a paper read before the North British Branch of the Pharmaceutical Society, Dec. 13th, 1876.) The microscope affords a ready means for the recognition of an admixture of seed or rind with the true pulp of colocynth. The most general and characteristic test for the former is to be found in the cells of the cotyledons. If a small portion of the suspected powder be placed on a glass slip, a drop of water added, and the cover glass gently rubbed on it, so as to extend the drop, these granules will be readily noticed. In the true powder no granules are to be seen, or at the most but one or two, but in proportion as more or less seed is present, so are the granules more or less numerous. Unless these constitute a considerable bulk of the powder, their presence should only be considered accidental, and the powder not be condemned on this account. It will be evident that when the seed is powdered the tissues will be also broken up, and fragments of these may be noticed. The commonest and most easy of detection is the double walled sac enveloping the embryo, showing on the outer side elongated, more or less hexagonal cells, and in the inner side a characteristic structure shown in the woodcut. (See *Pharm. Journ.*, p. 509.) Besides this, the spiral vessels are sometimes present, but these cannot be with certainty distinguished from those of the pulp. Stomata may and do occur, but their presence is so difficult of detection that they cannot be depended on. The episperm again, although it shows a characteristic structure on section, yet, in the state of powder, cannot be recognised. The rind, on the other hand, is still less frequently met with, but the characteristic stomata, in this case easily seen, would furnish a ready means of detection. In none of the examples examined by the author was any rind detected. Besides the admixture of the seed, powdered colocynth is liable to contain starch as an adulterant, but this of course is readily detected both by iodine and a microscope.

The author's report in the *Pharmaceutical Journal* is illustrated by an excellent woodcut, showing the microscopic appearance under a power of 470 diameters of the inner layer of embryo sac, the outer layer of ditto, cells of palisaded layer with granules, stomata from cotyledon, granules from cotyledons, epidermis of rind, and starch granule.

Pitury. Baron Mueller. (*British Medical Journal.*) A previous notice of this drug will be found in the *Year-Book of Pharmacy*, 1874, 52. Baron Mueller gives in an Australian journal an account of his recent examination of the leaves of the "pitury," said to be of great power as a stimulant, and to be found growing in desert scrubs from the Darling River and Barcooto to West Australia. It is his opinion that it is derived from *Duboisii Hopwoodii*, described by him in 1861, the leaves of which are chewed by natives of Central Australia to invigorate themselves during long foot-journeys. The blacks use it to excite their courage in warfare; a large dose infuriates them. The *Sidney Herald* is informed also that some dry leaves and stems, said to come from far beyond the Barcoo country, and called "pitcherine," are used by the aborigines as we use tobacco, for both chewing and smoking; and it is stated also that a small quantity causes agreeable exhilaration, prolonged use resulting in intense excitement. It is observed that the blacks, after chewing the leaves, plaster the quid so formed behind the ears, believing that this increases its effect.

The Root of Euphorbia Ipecacuanha. P. H. Dilg. (*Amer. Journ. Pharm.*, Nov., 1876.) The author collected the root in New Jersey late in September, and on repeating some of Mr. Petzelt's experiments (see *Year-Book of Pharmacy*, 1874, 125) did not obtain any reaction for glucose until after the decoction had been boiled with an acid.

The alcoholic extract obtained by spontaneous evaporation was of a light brown colour, and contained some crystals; ether extracted from it some oil and waxy matter, and a compound, which, on evaporation from petroleum benzine, yielded clusters of radiating crystals.

On percolating the root with petroleum benzine and evaporating the menstruum, a yellow tenacious mass, intermingled with thin colourless needles, was obtained. This benzine extract was completely dissolved by chloroform and bisulphide of carbon, the latter solution being turbid; ether dissolved it partially, leaving a white flaky residue, and alcohol acquired a yellow colour without affecting the shape of the extract, which appears to consist mainly of caoutchouc. From the alcoholic solution a warty crystalline mass was obtained, which responded to the test for euphorbon as given by Flückiger ("Pharmacographia," p. 504).

The author did not succeed in isolating the emetic principle; and in concluding his essay he states that only two houses in this city quote *Euphorbia ipecacuanha* in their price lists, but one only had it in stock, charging for it 75 cents per pound. On examining a dozen price lists from eclectic druggists in different parts of the country, one from Boston was the only one quoting it, and from that house a package was obtained, marked *Euphorbia Americana*, but containing the root of *Gillenia stipulacea*. If it was ever used to any extent, the drug has evidently become obsolete, and might well be dropped from the Pharmacopœia.

Potalia Amara. A. Haller and E. Heckel. (*Journ. de Pharm. et de Chim.*, xxiv. 247.) The authors have received and examined a few fruit-bearing specimens of this plant, which is a native of Cayenne. Aublet, who has given a short description of it in his "Histoire de la Guyane Française," ii., 394, says: "All parts of the plant are bitter. The young stems exude a yellow, granular, transparent resin, which when burnt emits an odour resembling that of benzoin. Infusions of the leaves and of wood of young stems are employed in small doses as a remedy for syphilis; in larger doses they act as emetics."

The statement that all parts of the plant have a bitter taste is contradicted by the authors, who found that the leaves, bark, and root, are devoid of bitterness; whereas the wood is both aromatic and bitter.

As potalia belongs to the *Strychneæ*, various parts of the plant were examined for strychnine and brucine, but no satisfactory evidence of their presence could be obtained. The authors intend to resume their investigation on the receipt of larger quantities of material. The results thus far obtained point to the presence of a bitter poisonous principle possessing powerful emetic properties.

Hoang-Nan. M. Planchon. (*Journ. de Pharm. et de Chim.*, 1877, 384.) Hoang-Nan is the name of a bark which is said to be much esteemed in Tong-King (in Eastern Asia) as a remedy for hydrophobia. Specimens of it received by the author correspond in every particular with the bark of *Strychnos nux vomica*. Missionaries report that the brownish dust which covers the bark is the part employed by the natives, who regard the woody portion of the bark as inert, but believe the external dust to contain a strong poison. From Pelletier's investigation of false angostura bark, it is known, however, that the poisonous constituents (strychnine and brucine) are located, not in the outer corky layer, but in the woody tissue below.

Some Constituents of Gelsemium Sempervirens. F. L. Sonnenschein. (*Pharm. Journ.*, from *Ber. der deutsch. Chem.-Ges.*, xi., 1182.) For several years past various preparations of the so-called Carolina jasmine (*Gelsemium sempervirens*, Pers.) have been used in medicine in North America, the two principal being the fluid extract and "gelsemin." The first of these is a concentrated alcoholic extract, the latter is a dried alcoholic ethereal extract, containing much resin. Notwithstanding that different chemists, and more recently Wormley, have been engaged in the investigation of this drug, hitherto no exact information has been given as to the composition and nature of the two principal constituents, namely, a non-nitrogenous body approaching to an acid, and a non-nitrogenous basic compound. In a paper lately read before the Berlin Chemical Society, Professor Sonnenschein gives the following information, which is based upon a series of experiments carried out in his laboratory with a suitable supply of material, by Mr. C. Robbins, of New York.

The powdered root was extracted to exhaustion with a mixture of equal parts of alcohol and water; the extract was concentrated, and after separation of the resin thus thrown out of solution basic lead acetate was added, as long as any precipitate was formed. This precipitate served especially for the preparation of the indifferent compound. A mixture of one part of ether and three parts of alcohol used instead of the aqueous alcohol for extraction gave a larger yield. The filtered liquid was used for the separation of the nitrogenous body.

The lead precipitate was suspended in water, decomposed by sulphuretted hydrogen, filtered, the filtrate concentrated by evaporation, and the liquid so obtained was shaken several times with ether. The ethereal solution, upon spontaneous evaporation, left behind some light acicular crystals, which had to be separated from adhering resinous matter by treatment with absolute alcohol. The same compound may be obtained direct by shaking the commercial fluid extract with ether, a method that was adopted by Wormley.

Thus purified, this substance is white, crystallizes readily in tufts, is without smell, and almost tasteless, and possesses feebly acid properties. The acicular crystals are best obtained after slow crystallization from an alcoholic-ethereal solution. If heated to about 160° C., this substance melts, and solidifies upon cooling to an amorphous mass. Upon heating it above the melting-point it is decomposed and turns brown, and upon raising the temperature still higher, it is at last completely volatilized. If heated very carefully, a portion can be sublimed. The compound is soluble with difficulty in cold, but much more readily in hot water; it is soluble in about 100 parts of cold alcohol, almost insoluble in pure ether, but easily soluble in ether containing alcohol.

The aqueous solution is distinguished by its fluorescence, which can be observed even after very considerable dilution. In an alkaline solution this appearance becomes yet more manifest; the solution then appears yellow by transmitted light, and by reflected light blue.

Concentrated sulphuric acid dissolves this substance with a reddish yellow colour; carefully heated, the solution becomes chocolate brown. Hydrochloric acid causes no particular change of colour. If the substance be shaken with a small quantity of nitric acid a yellow solution results, which upon the addition of ammonia takes a deep blood red colour. This reaction is so delicate that 0·00002 gram can be detected by it.

The same results were obtained by Wormley, who named the compound "gelseminic acid;" principally because of its acid reaction, but also because the compound with an alkali produces precipitates in the solutions of most of the heavy metals. These precipitates Wormley considered to be insoluble gelseminates. Careful experiments and examination under the microscope have, however, proved that with the exception of the lead compound they consisted of the hydrated oxides of the metals mixed with the supposed acid.

It was, therefore, thought probable that this substance instead of being a new acid would prove to be identical with æsculin (formerly called polychrom), obtained from the bark *Æsculus Hippocastanum*. An agreement was observed in its external characters as well as its chemical behaviour, especially in the blue fluorescence of the aqueous solution, the dichroism of an alkaline solution, the reaction with nitric acid and ammonia, and its behaviour at high temperatures. This agreement was established by parallel experiments with commercial æsculin. Also, by digestion of æsculin prepared from gelsemium with dilute sulphuric acid sugar and separated and detected by Fehling's test.

In order further to establish the identity of the two substances a combustion was made with some of the prepared substance that had been dried at 115° until it ceased to lose weight. There was found—

	I.	II.
C	52·04	51·82
H	5·18	4·98

According to Roehleder, æsculin has the formula $C_{30}H_{34}O_{19}$, which would give a percentage composition of C, 51·57; H, 4·87.

A further confirmation was found in the hydration. The air-dried substance obtained from gelsemium lost at 110° C. 4·73 per cent of water. Æsculin = $C_{30}H_{34}O_{19} + 2$ aq. lost by drying 4·90 per cent.

Professor Sonnenschein, therefore, thinks there can be no doubt that the acid reacting body prepared from gelsemium is perfectly identical with æsculin.

The solution from which the lead precipitate had been separated was freed from dissolved lead by sulphuretted hydrogen; then from the still acid liquid any yet remaining æsculin was removed by shaking with ether, the ether was chased off by heat, and potash added up to an alkaline reaction. A light flocculent precipitate was thus thrown down, which was collected on a filter, and after washing, which could not be continued long on account of it being slightly soluble, it was dissolved for purification in hydrochloric acid. The filtered solution was, after the addition of potash, several times shaken with ether, which was left to evaporate spontaneously, when a colourless, transparent, varnish-like coating was left on the sides of the vessel. It was found that the largest yield of this substance was obtained from the aqueous alcoholic extract.

When the dish was gently warmed the residue puffed up strongly whilst parting with entangled ether, and then appeared as an amorphous, transparent, brittle mass, which could be rubbed to an almost colourless, perfectly amorphous powder. Upon gently heating this it melted, under 100° C., to a colourless liquid; at a higher temperature it was partially decomposed. In water it was with difficulty soluble, more readily in alcohol, and very freely in ether and chloroform. Its reaction was strongly alkaline, and its taste very bitter.

The behaviour of this body, which has all the characters of an alkaloid, and has been named gelsemine, was briefly as follows:—

It completely neutralized acids, but hitherto no crystallizable salts have been prepared. The combination with hydrochloric acid, upon evaporation over sulphuric acid, leaves an amorphous mass, which is white in the centre, red towards the periphery, and blue-grey at the outer edge.

The residue readily formed a solution with water, which only when concentrated gave a white precipitate with tannin, but when diluted gave it first with ammonia. Gold chloride gave a yellow precipitate that was not altered by heating. Iodine in iodide of potassium gave a flocculent red-brown turbidity, which became somewhat conglomerated by heating. Potassio-mercuric iodide gave a white flocculent precipitate, which dissolved upon heating, and again separated on cooling. Phosphomolybdic acid gave a flocculent yellow precipitate. Platinic chloride gave an amorphous citron yellow precipitate, soluble in water, especially upon heating. It was also readily soluble in alcohol. An aqueous solution of the platinum salt left upon spontaneous evaporation transparent square octahedra, which upon the addition of water immediately took the amorphous form, with separation of platinum chloride.

The pure alkaloid dissolves in concentrated nitric acid with a yellow-green colour. In concentrated sulphuric acid it gives at first the same colour, but this passes immediately to a reddish brown, and upon heating to a dark dirty red colour.

If gelsemine be dissolved in concentrated sulphuric acid and potassium bichromate be added, it takes, especially at the line of contact, a cherry red colour, changing a little to violet, which soon forms a bluish green spot. This reaction cannot be confounded with that of strychnine, although it shows some similarity. If instead of potassium bichromate ceroso-ceric oxide be added to the sulphuric acid solution there is produced a bright light cherry red colour, especially at the point of contact, which by stirring is diffused through the mass. This reaction takes place so sharply with the smallest trace that it may be looked upon as the best test for the presence of gelsemine.

The amorphous platinum precipitate left upon incineration 16·25 and 16·85 per cent. of metallic platinum. The hydrochloric acid compound contained 8·73 per cent. of chlorine. Upon incineration with soda lime the nitrogen in two experiments was found to equal 7·26 and 7·23 per cent. The carbon found in two experiments was 66·10 and 66·41 per cent., and the hydrogen 9·44 and 10·05. This allows of the construction of the following formula for gelsemine—$C_{11} H_{19} N O_2$.

	Calculated.	Found.	
		I.	II.
C 11 = 132	67·00	66·41	66·10
H 19 = 19	9·64	10·05	9·44
N = 14	7·10	7·26	7·23
O 2 = 32	16·24	16·28	17·23

This formula, however, has to be doubled if it depends on the hydrochloric acid compound, since this contains 8·73 per cent. of chlorine. $(C_{11} H_{19} N O_2)_2 + H Cl$ requires 8·24 per cent of chlorine.

According to the platinum left after incineration the platinum compound must have a composition represented by $[(C_{11}H_{19}NO_2)_2 HCl] PtCl_4$, which would explain its behaviour in water by the formation of a basic salt.

0·012 gram of the hydrochloric acid compound injected into the leg of a strong pigeon caused manifestations of cramp, followed by death in thirty-six minutes. Similar results were obtained with frogs.

The Relative Value of Colchicum Root. Prof. Beckert. (From an inaugural essay: *Amer. Journ. Pharm.*, 1877, 433.) This subject was suggested by several pharmacists, who of late have found it a difficult matter to obtain colchicum root which on breaking presented a clear white colour. The article, as obtained from the wholesale druggists, consisted of tubers which had been sliced very irregularly. Out of a pound lot not less than seven whole tubers were taken, the remainder varying from one-sixth to one-half inch in thickness. These pieces, when broken, presented quite a varied appearance, their colour being all shades between white and black; and it was noticed that the lighter coloured roots were mostly easy to break, and many of them of a mealy character, whereas the darker ones were difficult to break, and had a somewhat resinous appearance. A quantity of the root was broken piece by piece, and then separated into three grades, according to colour, white, slate-coloured, and brown or blackish, particular care being taken in the sorting. Upon weighing, it was found that the white root constituted only one-sixth, while the grey root comprised not quite two-sixths, and the black root a little over three-sixths of the article examined. These results also agree with the observations of several resident pharmacists.

The methods used to determine were as follows:—Two troy ounces of each of the three grades of roots were exhausted by means of alcohol, yielding in each case about twelve fluid ounces of tincture; these tinctures varied in colour according to the grade of root used, that from the white root being lightest. This indicates the solubility in the alcohol of the foreign colouring matter present in the grey and black roots. In preparing these tinctures, care was taken to percolate them under as similar circumstances as possible.

The tinctures obtained were separately evaporated by means of a water bath, the residue was treated with distilled water, and poured upon a filter, in order to separate resinous matter; the filtrate was washed with slightly acidulated water until each filtrate measured 100 c.c. Dilute sulphuric acid was used for acidulating the solutions, which were volumetrically tested with Mayer's solution, in quantities varying from 5 to 15 c.c. In the preliminary experiments the solutions were variously diluted, and it was observed that the results were very considerably influenced thereby, an observation previously made by Dragendorff. To serve as a basis for comparison, the experiments were afterwards made with solutions of uniform strength, as stated above, partly without any other addition. and partly as recommended by Dragendorff, after the addition of a concentrated solution of chloride of sodium, to increase the distinctness of the reaction. The three grades of the root required for 1 c.c. respectively ·0403, ·0414, and ·0462 of Mayer's solution.

Five troy ounces of each of the roots were next exhausted by alcohol, percolation in each case being carried on until the liquid passed tasteless. The alcohol was evaporated, and the residues were treated with water, filtered and precipitated by a solution of tannin. These tannates of the white, grey, and black roots, which, after having been dried, weighed respectively ·32, ·265, and ·27 gram, were decomposed by oxide of lead, and then treated with alcohol, in order to separate colchicia. The three alcoholic solutions were carefully evaporated to dryness, then placed over sulphuric acid for several days, and then their weight taken ; the product from the grey root weighing ·115 gram, the black yielding ·104 gram, while the product from the white root was unfortunately lost.

The author next obtained some colchicum root from Professor Maisch, which was not less than ten years old, it having been in his possession at least nine years. It had quite a handsome appearance, very little dark root being present, and in all respects was a much better looking article than that previously employed. Two troy ounces of this root were treated as above stated, and an acid solution obtained measuring 100 c.c., and which, when treated with Mayer's test, in a similar manner as before, required ·0300 for the precipitation of 1 c.c.

The various results thus obtained are more concisely presented in the following table:—

	White Root.	Grey Root.	Black Root.	Very old Root.
Mayer's solution required to precipitate 1 c.c. of the solution	·403	·414	·492	·0300
Percentage of alkaloid in air-dry root .	·205	·210	·219	·152
Tannate precipitate obtained from 5 troy ounces of root	·320	·265	·270	—
Amount of crude alkaloid from the tannates	lost	·115	·104	—

From this table it will be seen that the results obtained with tannin and Mayer's solution do not agree as to the amount of colchicine indicated. This may be due to the slight solubility of the tannate in water, as observed by Hübler and others, and to the varying amount of water used in the last experiments. But the results appear to indicate that it matters little whether the root has a white, grey, or black colour; but that the age is of primary importance, and that none but a root of fresh appearance should be used by the pharmacist.

Colchicum Seed. N. Rosenwasser. (From an inaugural essay: *Amer. Journ. Pharm.*, 1877, 435.) The author prepared the active principle of the seed, and found it to have a neutral reaction to test paper, and to be not precipitated from aqueous solutions or solutions acidulated with organic acids, by potassio-mercuric iodide, sodium phospho-tungstate, auric chloride, phosphomolybdic acid, and solution of iodine, all of which reagents afforded precipitates after the solution had been acidulated with a mineral or oxalic acid, or had been boiled for a few minutes with acetic acid. [Ludwig (1862) obtained a thick precipitate with auric chloride, readily soluble in excess, and Eberbach (1874) found the aqueous solution of his colchicia, which had a distinct alkaline reaction, to be precipitated by the three last reagents mentioned above.] The author argues from this that the principle is naturally neutral, and is converted into an alkaloid by the influences mentioned. The neutral substance, colchicin, was with some difficulty obtained in crystals by the slow evaporation, in deep vessels, of its solutions in fusel oil and benzol, and found to be insoluble in *pure* ether, carbon bisulphide, and petroleum benzin.

It having been asserted that the active principle resided chiefly in the outer integuments of the seed, and that for this reason they could be almost completely exhausted without being ground, the author experimented with 5000 grains of unbroken seeds, macerated them in diluted alcohol in a warm place for ten days, and washed them well with diluted alcohol; the tincture and washings were used for preparing colchicin by Carter's process (*Amer. Journ. Pharm.*, 1858, p. 205), of which five grains were obtained. The same seeds afterwards crushed to an uniform powder, yielded eleven grains of colchicin. 5000 grains of seeds of the same lot were ground, and yielded sixteen grains; and 14,000 grains of the same seeds, rolled and crushed, yielded forty-five grains of colchicin. It follows, therefore, that only less than one-third of the colchicin present can be exhausted from the unbroken seeds. In preparing colchicin, particularly in warm weather, it is found unnecessary to remove the fixed oil by filtration previous to precipitating the colchicin by tannin; it is better to collect the precipitate, dry it carefully by means of a water bath, and then exhaust the oil by gasolin. For the decomposition of the tannate, aluminium hydrate seems to possess decided advantages over ferric or plumbic hydrate, it serving at the same time as a decolorizing agent.

When distilling the alcohol for the tincture, the odour of the *ground* seed was distinctly recognised in the distillate, which turned milky upon the addition of water. On distilling a pound of the ground seeds with water, an aromatic distillate was obtained; but a volatile oil, which probably exists in minute quantity, could not be separated. The distillate was tested for alkaloids with a negative result.

Flückiger and Hanbury give 6·6 per cent. as the amount of fixed oil present in the seeds; the author obtained 14 drams (8·4 per cent.) from 10,000 grains of the seeds. After purifying it by treatment with benzin and animal charcoal, it had a light brown colour and a bland taste. It was found to be readily saponifiable.

Pao Pereira. MM. Rochefontaine and De Freitas. (*Pharm. Journ.*, from *Comptes Rendus*, lxxxv., 412.) The pao-pereira tree is a native of Brazil, and its bark has been much used by the physicians of that country since Professor Silva, about the year 1830, made known its febrifuge and antiperiodic properties. It belongs to the Apocynaceæ, and has been variously designated as *Picramnia ciliata*, *Vallesia punctata*, *Tabernæmontana lævis*, and *Geissospermum Vellosii*. Professor Baillon is, however, of opinion, after a recent examination of leaves and stems received from Brazil, that it should bear the name of *Geissospermum læve.*

The bark of this plant contains an alkaloid in great abundance; this was first extracted in 1838 by Santos, and called by him "pereirine," but the authors propose to change this name to "geissospermine," after the generic name of the plant.

The dried leaves at the disposal of the authors had an extremely bitter taste, analogous to that of *Quassia amara*, which became manifest after chewing them for a few seconds. This state being similar to that of the stem bark suggested the presence of a certain proportion of alkaloid in the leaves. Some leaves were therefore macerated in dilute alcohol, and from the liquor thus obtained an alkaloid was obtained, as was a similar one also from an aqueous maceration of bruised leaves. It seems therefore that the leaves contain the alkaloid, though in less quantity than the bark, and this is confirmed by the physiological action of the aqueous extract of the leaves on frogs.

The alkaloid of *Geissospermum*, as employed in Brazil, is not a chemically pure product; it occurs under the form of a brownish yellow amorphous powder, the bitterness of which resembles that of the leaves and the bark. Although daily employed in Brazil for many years past, the physiological action of neither the alkaloid nor the bark appears to have been studied experimently. The authors therefore took up the investigation, using geissospermine dissolved in water or alcohol, and alcoholic and aqueous extracts of the powdered bark.

The experiments showed that geissospermine is a toxic substance, exercising no local irritant action when administered subcutaneously. Two milligrams introduced under the skin caused the death of a frog; paralysis was produced by half a milligram. A full-grown guinea-pig was killed by one centigram, and fourteen centigrams completely paralysed a small dog. The symptoms were a slackening of the cardiac beats, and of the respiratory movements. The voluntary movements were first paralysed, the reflex movements gradually ceasing subsequently. The sensitive nerves appeared to preserve their functions as long as the motor nerves. The muscular contractility was not affected. The authors therefore consider geissospermine to be a poison which acts by destroying the physiological properties of the central nervous grey matter.

Indian Drugs. W. Dymock. (*Pharm. Journ.*, 3rd series, vii., 3, 109, 170, 190, 309, 350, 450, 491, 549, 729, 977.) This is a most important contribution to pharmaceutical literature, embracing as it does a description of a very large number of Indian medicinal plants. Owing to the great length of the report, which is not yet concluded, and its unsuitability for useful abstraction, we must confine ourselves here to a mere reference to the original.

PHARMACY.

PART III.

PHARMACY.

Emulsions. E. Gregory. (From a paper read before the American Pharmaceutical Association.) The following are the results of the author's experiments made with the object of testing the merits of the various processes employed in making emulsions:—

1. The method which directs that equal parts of mucilage of acacia and oil should be put into a bottle and well shaken together, the requisite quantity of water being gradually added. If the mucilage be fresh, the bottle only partially full, and the shaking very vigorous, tolerable results can be obtained with castor oil, moderate results with balsam copaiba, and with oil of turpentine a total failure. But in all cases the oil globules are distinctly visible to the naked eye.

2. Equal parts of oil and mucilage are put into a mortar together, and briskly triturated. This gives barely tolerable results with the balsams and thicker oils; but with oil of turpentine it is a total failure, no amount of labour producing the slightest effect.

3. Equal parts of oil and mucilage, the oil to be gradually added, triturating briskly after each addition until the portion added is emulsified. A fair result can be obtained by this process if the operator have plenty of patience and a liberal supply of muscle; but the product is too dark in colour. The oil globules are not visible to the naked eye, but can be easily seen with a magnifying power of three diameters. It separates into two layers in two and a half hours, the lower layer being dark but not watery.

4. The next process is that wherein equal parts of mucilage, water, and oil are put into a suitable vessel, and agitated with an egg-beater until emulsionized. This yields a tolerable result, is simple, and requires no skill, but is rather laborious, and yields a product very dark in colour. The oil globules are not visible to the naked eye, but quite distinctly under a power of three diameters. It separates into two layers in three hours, the lower layer being very watery.

5. The next process tried was that of Mr. Charles F. Hartwig (published in the *Pharmacist*, October, 1875), in which one part of mucilage and one part of water are put into a suitable vessel, thoroughly mixed by being drawn up into and ejected from a small

vaginal syringe, and one part of oil having been added, the emulsion is produced by the use of the syringe alone in the same way. This process yields excellent results, but the emulsion is not quite as white as it should be; the process is rather tedious, and the after-cleaning very troublesome. It is the best of the processes in which officinal mucilage is employed. The oil globules are invisible to the naked eye, but are distinctly seen with a power of three diameters. It separates into two layers in twenty hours, the lower layer being milky in appearance.

6. A process published in the *Journal of Pharmacy*, in February, 1872, by Mr. J. Winchell Forbes, and apparently designed more especially for oil of turpentine, in which he directs that one part of oil shall be put into a bottle and shaken, then one-eighth part of pulverized acacia, and after thorough agitation, half a part of water added, the whole to be then vigorously shaken until emulsified. The resulting emulsion is deficient in whiteness. The oil globules are distinctly visible, as a multitude of gem-like points, under a magnifying power of three diameters, and are also visible to the naked eye if a drop be placed on a piece of glass and held up between the eye and the light. It separates into two distinct layers in fifteen minutes, the lower layer being quite watery, but it easily reunites on shaking.

7. If, however, in the preceding process, three-eighths of a part of pulverized acacia be used instead of one-eighth, a very good result is obtained, the product being much whiter, the oil globules about half the size, and quite invisible to the naked eye. It now takes twelve hours to separate into two layers, the lower layer, however, being still watery.

8. The next process for consideration is described on page 343 of "Mohr and Redwood's Pharmacy," English edition of 1849, in which one part of pulverized acacia and one and a half part of water are put into a mortar, and after thorough trituration three parts of oil are added gradually, each separate portion being emulsified before another is added. The results are admirable, the product being white as milk. The oil globules are not visible to the naked eye, but slightly so under a power of three diameters, and it does not separate into two layers under twenty-four hours, the lower layer having the appearance of milk.

9. The last process referred to is recommended by Mr. Hans M. Wilder, in the *Druggists' Circular* for December, 1874. One part of pulverized acacia and two parts of oil are put into a mortar and rubbed together; one and a half part of water is then added at once, and with a few revolutions of the pestle the

whole is emulsified. It appears to yield the very best results. The emulsion is beautifully white, scarcely to be distinguished from milk, and the necessary manipulations are very speedy and simple. The oil globules are totally invisible to the naked eye, and not very perceptible with a power of three diameters. It separates into two layers in twenty-four hours, the lower layer being quite like milk, whilst the upper would pass for cream; and at the time of writing this, four days after making, retains the same appearance, and is by far the best out of six samples that are standing undisturbed before the author.

In summing up his results, the author states that the use of mucilage should be abandoned in favour of powdered gum. He thinks that three drams of acacia in fine powder are necessary to emulsify one ounce of any of the volatile oils, and that a little less (about two drams) will answer for the fixed oils and balsams. And that to this quantity of gum four drams and a half of water must be added (no more and no less), and that either the water or the oil may be added first to the gum, but it is quickest to add the oil first, and well triturate before adding the water. Less gum can be made to yield a good result by a careful operator; but as a general practical working rule, it may be said that three drams are necessary for one ounce of oil.

Officinal Tinctures. B. F. McIntyre. (A contribution to the literature of the proposed International Pharmacopœia. From a paper read before the Alumni Association of the College of Pharmacy, New York.) Percolation, in the writer's opinion, is an unexceptionable process, if conducted with care and skill. The British Pharmacopœia directs maceration of the drug with only a portion of the menstruum, the residue to be freed from tincture and extraction by percolation with fresh spirit until a prescribed measure is obtained.

The German process, which like that of the French Codex, consists in the maceration of the drug with the full quantity of menstruum, would be more in harmony with other authorities if a definite measure or weight of tincture could be got from the specified parts of the drug; the difference now is considerable where force from handscrew or hydraulic press is applied to the expression of marc or residue. This, however, is only an economic point for consideration. The loss may be seen in the annexed table, by comparing the actual weight of tincture obtained from the drug after maceration with the theoretical quantity, or the proportional medicinal strength of the finished tincture given in the next column.

In the experiments tabulated below, the manipulations directed by, and characteristic of, the several pharmacopœias were followed, though the menstrua for the exhaustion of the drug were disregarded, except when they were of the same spirit strength as that designated in the U. S. P. This was necessary in order to sustain the object of this paper, the finding of the exact parts by weight of tincture; the determinations being based on repeated experiments and calculations made from weighings of hundreds of gallons of official tinctures.

As the German Pharmacopœia specifies that tincture of belladonna and digitalis be prepared from the fresh herb, calculation was made for loss in the drying of the herb, and the powdered drug was used instead.

PARTS BY WEIGHT OF TINCTURE CONTAINING THE SOLUBLE PORTION OF ONE PART BY WEIGHT OF DRUG.

Tincture.	U. S. P.	B. P.	German Pharm.		French Codex.
			‖	†	
Aconite Root	2·13	6·71	9·30	10	5·00*
Belladonna	7·20	19·18	7·62	—	5·00
Cannabis Indica	17·80	15·54	20·00	20	—
Calisaya Bark	4·67	4·74	4·12	5	5·00
Cantharides	28·25	76·26	9·36	10	10·00*
Colchicum Seed	7·09	7·33	9·08	10	10·00*
Foxglove	7·30	7·73	5·95	—	5·00
Ginger	3·16	6·24	4·88	5	5·00
Henbane	7·29	7·64	—	—	5·00
Lobelia	7·12	7·61	8·85	10	5·00
Nux Vomica	3·15	8·41	8·97	10	5·00*
Veratrum Viride	1·59	3·63			
Opium	11·52	12·88	9·30	10	Ext. of Opium. 12·00*
Stramonium Seed	7·21	7·65	9·28	10	—
Valerian	7·13	7·68	4·79	5	5·00
Opium Camphorated.					Ext. of Opium.
Opium, Powdered	234·24	207·50	198·00	200	215·00
Benzoic Acid	234·24	207·50	49·50	50	215·00
Gum Camphor	315·36	276·66	99·00	100	323·00
Oil of Anise	257·86	138·33	99·00	100	215·00
Honey	14·66	—	—	—	—
Cinchona Compound.					
Cinchona Red	8·63	9·35	11·62	—	—
Orange Peel	11·50	18·74	34·87	—	—
Serpentaria	46·00	37·56	—	—	—
Saffron	—	154·69	—	—	—
Cochineal	—	309·38	—	—	—
Gentian	—	—	34·87	—	—
Cassia	—	—	69·74	—	—
Aloes.					
Aloes Soct.	30·82	38·16	5·90	—	—
Liquorice Extract	10·27	12·58	—	—	—

Tincture.	U. S. P.	B. P.
Benzoin Compound.		
Benzoin	10·12	9·80
Soct. Aloes	60·76	53·60
Storax	14·23	13 09
Balsam Tolu	30·38	39·67
Cardamom Compound.		
Cardamom	48·70	78·40
Caraway	145·83	78·40
Cinnamon	58·33	39·20
Cochineal	291·66	142·43
Honey	18·22	—
Raisins	—	9·76
Aloes and Myrrh.		
Aloes	9·26	—
Myrrh	9·26	—
Catechu.		
Catechu	9·64	—
Cinnamon	14·47	—
Gentian Compound.		
Gentian	14·36	13·06
Orange Peel	28·72	26·15
Cardamom	57·44	78·49
Rhubarb.		
Rhubarb	9·69	9·71
Cardamom	58·17	77·98
Coriander	—	77·98
Saffron	—	77·98
Rhubarb and Senna.		
Rhubarb	43·75	—
Senna	175·00	—
Coriander	350·00	—
Fennel	350·00	—
Liquorice	700·00	—
Raisins	21·87	—

Tincture.	U. S. P.
Iodine Compound.	
Iodine	28·07
Iodide of Potassium	14·07
——	
Assafœtida	6·35
Arnica	4·86
Benzoin	4·81
Bloodroot	7·12
Black Hellebore	7·29
Capsicum	28·00
Conium	6·97
Castor	12·76
Cardamom	7·06
Cinnamon	8·96
Columbo.	7 13
Cubeb	7·19
Guaiac	4·41
Guaiac Ammoniated.	4·86
Galls	7·44
Hop	5·69
——	
‡Iron	—
Iodine	13·53
Jalap	4·75
Kino	9·49
Lupulin	6·43
Myrrh	8·38
Opium Deodorized	12·50
Opium Acetated	9·27
Quassia	13·97
Orange Peel	7·30
Rhatany	4·86
Serpentaria	7·16
Squill	7·46
Tolu	9·69
Valerian	7·13
Valerian Ammoniated	6·60

‡ One fluid dram of tincture of iron, U. S. P., contains 3·53 grains of oxide of iron. One fluid dram of the same tincture, B. P., contains 3·90 grains of ferric oxide.

‖ Parts by weight of tincture actually obtained from one part by weight of the drug.

† Parts by weight containing the active principles of one part by weight of the drug.

* Tinctures directed to be made by maceration.

A New Application of Dialysis. R. Rother. (*Pharmacist*, January, 1877.) In the article on "The Inverse Synthesis of the so-called Tasteless Iron Compounds" (*American Journal of Pharmacy*, April, 1876), the author pointed out the important fact, that in particular cases of colloidal compounds the endosmotic current is the most prominent feature of the movement. On such occasions the inward course of the outer liquid appears to be the only force of the phenomenon, since exosmosis prevails so feebly that practically its effect is reduced to zero. The rapidity of the endosmotic current gives promise that a new development of this interesting and remarkable process will lead to great advantages in numerous and important pharmacal operations. This peculiarity presents a new means of concentrating solutions where the absence of heat is not only desirable, but often imperative. In its practical bearing this method of transcendental filtration presents a wide range of application, which must be classified, however, as entirely distinct from the present sense, and the theoretical action in which the process is usually considered. The residue, technically called the diffusate, is, according to the original idea of this process, a solution of the diffused substance. The residue of the new modification differs from the diffusate proper in the particular that it practically contains nothing originally introduced into the dialyser, but that it simply represents that portion of the original outer liquid which refused to pass inwards through the membrane. Therefore, according to the new construction, the process resembles filtration more closely than its primitive process from which it is derived. In some instances it is even more rapid than ordinary filtration. Absorption in this operation corresponds with volatilization in the usual method of concentration by means of heat. As the action of heat produces undesirable and often destructive changes in many substances, even at the lowest possible degree, the process of dialytic filtration must naturally commend itself on all such occasions, where its application is available. If the point of a parchment dialysing cone containing a concentrated solution of strongly colloidal substance be immersed in a dilute solution of a crystalloid, the superabundant water of the latter is more or less rapidly absorbed into the dialyser, leaving, after due action, the solution of the crystalloid in its utmost concentration. It is possible that this process may become useful in the industrial production of alkaloids, where in the usual method large volumes of water must be expelled by means of heat, the action of which, in many cases, greatly reduces the yield by the generation of inert modifications or worthless disruption products. This process, with its accompanying apparatus, is more congenial to the surroundings of modern pharmacal laboratories in which the routine is less interspersed with the manipulation of distrustful retorts, precarious capsules, and fuming crucibles of the empiric era. It would be hardly proper to designate this process dialysis, since that term specifically denotes an operation not exactly similar. Absorption also does not strictly convey the true meaning of its action; however, in case the new process should prove itself of such general value as the first indications seem to promise, a more appropriate term will readily be found.

The Preparation of Pyroxylin for Photographic and Pharmaceutical Purposes. W. Godeffroy. (*Zeitschrift des oesterr. Apoth. Ver.*, 1877, 209.) Most of the published formulæ for the production of pyroxylin yield a preparation which does not form a perfectly clear solution with ether, or a mixture of ether and alcohol. From the author's experience it appears to be advantageous to employ the acid mixture at a slightly elevated temperature. He uses potassium nitrate and sulphuric acid in the proportion of 350 grams of the former and 700 grams of the latter to 35 grams of cotton. A porcelain mortar is gently warmed on a sand bath, and the powdered saltpetre triturated in it until it is perfectly dry; the sulphuric acid is then added, and intimately mixed with the saltpetre, and the cotton immersed without removing the mortar from the bath. The cotton is first freed from fatty matter by heating it in a solution of sodium carbonate, then boiling it with water to which a minute quantity of caustic potash has been added, and finally washing it with pure water until the alkali is completely removed. Thus purified, and again dried, it is introduced into the acid mixture, well kneaded with it by means of a pestle, and left immersed for seven minutes. After this time it is quickly transferred to a large vessel containing hot water, then washed under a stream of cold water until the acid reaction has entirely ceased, and finally with distilled water. After removing the water by strong pressure, the pyroxylin is ready for use, and may be at once dissolved without further drying.

Mustard as a Deodorizer. F. Schneider. (*Pharm. Zeitung*, 1877, 119.) The author calls attention to the value of black mustard as a deodorizing agent. The odours of cod-liver oil, musk, valerianates, and many other drugs, can be rapidly removed by it from the hands, utensils, scales, etc. The farina is mixed with a little water before it is applied.

The Dispensing of Copaiba Resin. A. Balkwell. (*Pharm. Journ.*, 3rd series, vii., 431.) The following form of exhibiting copaiba resin has been found to give satisfaction both to prescriber and patient. It is easily prepared, and the mixture in appearance, permanence, and therapeutic action is said to be preferable to that of any form the writer has met with:—

℞	Resinæ Copaibæ	ʒiss.
	Ol. Amygdal. Dulc.	ʒiv.
	Mucil. Acaciæ	℥iss.
	Liq. Potassæ	ʒss.
	Ol. Cinnamomi	guttæ vi.
	Aquam	ad ℥vi.

A sixth part three times a day.

Dissolve the resin in the almond oil with gentle heat, then add the liq. potassæ, and form an emulsion.

An Improved Method of Making Mistura Guaiaci, and Similar Mistura. T. Greenish. (*Pharm. Journ.*, 3rd series, vii., 369.) The excipients suggested by the author are sugar of milk and alcohol, and answer well with resin of copaiba, guaiacum, and other resins. For mistura guaiaci, he recommends to rub the resin with *sugar of milk*, then to add alcohol and to produce a homogeneous mixture by trituration; to this is to be added powdered gum arabic, the trituration to be continued, and the water gradually added. The formula for mistura guaiaci would then stand thus:—

R	Guaiacum Resin in powder	½ ounce.
	Sugar of Milk	½ ounce.
	Gum Acacia in powder	½ ounce.
	Rectified Spirit	5 fluid drams.
	Cinnamon Water	to one pint.

The following formula affords an example of a good emulsion of copaiba resin:—

℞	Resinæ Copaibæ	ʒiss.
	Sacch. Lactis	ʒiij.
	Spirit. Vini Rect	ʒiij.
	Pulv. Acaciæ	ʒv.
	Aquæ ad	℥vj. Misce.

Pepsin and its Preparation. Dr. O. Liebreich. (*New Remedies*, from the *Practitioner*, March, 1877.) In a valuable paper on "The Use of Pepsin in Medicine," the author refers to the attempts that have been made to employ the peptones as therapeutic digestive agents, and their failure owing to the rapidity with which they undergo decomposition. He expresses his belief that the field of usefulness of pepsin in practical therapeutics is very great, and that it may be still further extended with very great advantage. But the success of this remedy has been greatly hindered, and the result of clinical and of scientific experiment as to the results which may be obtained have been much confused by the number of comparatively worthless preparations which have been employed, and by the instability and uncertainty of some of those preparations which in their most active states have from time to time yielded excellent results, and have thus attained a good reputation. The uncertainty of a potent remedy is almost as injurious and even more misleading than the inertness of a popular remedy, and the treatment of disorders of digestion by pepsin has suffered greatly from both these drawbacks and from both these sources of fallacy.

Following the description of a number of conditions in which the employment of pepsin as a remedy is calculated to be of benefit to the patient, the author remarks that there are certain counter indications of the use of pepsin, to which it may be well to refer. Among them are carcinoma and ulceration of the stomach. When there is an ulcer of the stomach it is an object of treatment to afford a smooth covering to the ulcer by bismuth, or by the administration of nitrate of silver; to administer pepsin is to incur the risk of hastening the process of thinning, which there is already too much reason to fear from the action of the normal pepsin of the stomach.

To fulfil the therapeutical indication of pepsin it is, however, necessary to have a pure and reliable sample. There are various methods of obtaining the article. Thus, there is the method of Brücke, by treating the gastric juice (obtained by well-known methods), with a solution of cholesterine in ether; the cholesterine, being precipitated, enters into mechanical combinations with the pepsin, and pure pepsin is obtained by removing the cholesterine by the further addition of ether.

This form of dry pepsin is absolutely pure, and from it may be learned the qualities and powers of pepsin. But the method is too costly for general use, and its advantages are mainly for scientific purposes. There are various dry preparations of pepsin in powder and cake, which are well known, and much used in medicine. But these preparations are very far from stable or reliable, and however active some of them may be when perfectly fresh, they do not remain active, and a large part of the pepsin powders prescribed are absolutely inert. Pepsin, although an albuminoid, differs, among other things, from ordinary albumen in being soluble in diluted alcohol. Advantage has been taken of this to prepare pepsin wines, but the alcohol does not prevent the ferment from undergoing change, and if a "pepsin wine" be examined after some time, it will be found not to contain a trace of pepsin, and to be absolutely devoid of digestive power. The author found, many years ago, that to preserve the ferment of pepsin there is only one reliable agent, that is glycerin, the powerful preserver of vaccine-matter and other animal ferments. His first researches on this subject, made many years ago, have been amply confirmed by a great number of observations, and for all scientific experiments on digestion he has now for many years employed only these solutions. He strongly recommends practitioners, for all therapeutical purposes, to employ such a solution. In this way they will avoid the fallacies and disappointment due to the employment of deceptive and unequal preparations, and they will the more readily define the true limits of pepsin as a therapeutic agent, and its place in the armoury of medicine. It is not to be reckoned among the most powerful and heroic remedies, but it is one which is of very agreeable and efficacious action; which very frequently gives exceedingly good results in large classes of ordinary and troublesome complaints, and which may be employed with confidence and advantage when its powers are stable and reliable.

The Constituents of Syrup of Phosphate of Iron. E. B. Shuttleworth. (*Canadian Pharm. Journ.*, August, 1876.) During the past few years there have appeared in the pharmaceutical journals numerous papers and notes on phosphate of iron and the syrups containing it. The author in the present essay reviews this literature, with the object of representing in as concise a form as possible the main points of the subject, omitting all unessential details.

Phosphoric Acid.—Of this substance there are several varieties. The *tribasic* acid, having the composition $H_3 P O_4$, combining weight 98, is that used in medicines. In order to distinguish this form from the others add a little tincture or solution of perchloride of iron; if the mixture remains clear the tribasic acid is present, otherwise a whitish precipitate is produced. The official form of this acid is the *Acid. Phosphoric. Dilutum*, but, in order to avoid disappointment it is always well to submit this preparation to the above test. If a precipitate is produced, boil down the acid to the consistence of syrup, *allow it to cool*, and add water up to the ordinary bulk. If the official acid is not at hand the glacial acid may be substituted, being previously treated with nitric acid after the manner of the United States Pharmacopœia. This will not always furnish the tribasic acid, and simple solution and evaporation of the glacial acid, without the addition of nitric acid, often gives as good results. Neither method can be relied upon with all samples of acid. The preparation of phosphoric acid from phosphorus should never be attempted by the pharmacist. The process requires much care and experience, is not economical, except with large quantities, is attended with the evolution of poisonous and disagreeable gases, and like all operations with phosphorus, is always more or less dangerous.

For preparing syrups, and indeed for most purposes, an acid stronger than that official (10 per cent. anhydrous acid) might be advantageously employed. The so-called *syrupy* acid, which can be obtained from some manufacturers, and which is about five times stronger than the other (49 per cent. anhydrous acid, and of sp. gr. 1·5) will be found very useful.

Phosphate of Iron.—Five methods have been recommended for preparing this substance:—(1) By mixing together solutions of sulphate of iron and phosphate of soda; (2) by using these salts with the addition of acetate of soda; (3) by substituting carbonate or bicarbonate of soda for the acetate; (4) by employing an excess of phosphate of soda; (5) by forming the phosphate by direct combination of phosphoric acid and metallic iron. By the first method, which is that of the United States Pharmacopœia and Parrish's "Pharmacy," about 30 per cent. of the phosphate of iron escapes precipitation, as the free sulphuric acid, liberated in the reaction, dissolves or holds this amount. The framers of the British Pharmacopœia sought to escape this loss by employing acetate of soda for neutralizing the free sulphuric acid, as in the second method. This addition has been shown to be an improvement, but is still in great part ineffectual, as from 22 to 28 per cent. of the phosphate is lost. In the third method, that of Mr. Schweitzer, in which carbonate or bicarbonate of soda is employed, the loss is reduced to less than one per cent. The fourth method, that of Mr. Rees Price, is said to yield results equally satisfactory, but nearly three times the usual quantity of phosphate of soda is required. On the score of economy this is quite a consideration. The fifth method, that of direct combination, answers well where time is not an object. If acid of sp. gr. 1·5 be used, it should be diluted with an equal weight of water, and the iron should be in the form of filings, preferably of Swedish, or wrought metal. In order to produce a preparation similar to the *Syr. Ferri Phosphatis*, B. P., and containing one grain of phosphate in each fluid dram, the following formula may be employed:—

Iron	38 grains.
Phosphoric Acid, sp. gr. 1·5	6 fluid drams.
Water	6 ,, ,,
Syrup	8½ fluid ounces.

Mix, in a flask, the phosphoric acid and water; add the iron, and plug the mouth of the flask with cotton; when the iron is dissolved, filter the solution and add it to the syrup.

The blue phosphate of iron is not a substance of very definite composition, and it is questionable whether the above methods furnish compounds which are identical. Even when the same ingredients are used in proportions exactly alike, the products may differ if the details of manipulation be changed. In all cases the intention is to produce ferrous phosphate, but this is never altogether accomplished, as a great portion of the salt passes to the ferric condition; or, as may be better understood, passes from a proto to a per salt. An analysis of six samples of commercial phosphate showed a range of from 20 to 46 per cent. of ferrous salt. It appears likely that the last method noted above would yield a preparation richer in ferrous salt than any of the others, but it is said that the third method gives a salt containing 51 per cent., which is more than 5 per cent. better than the B. P. standard.

Taking everything into account, the author much prefers this process, and has used it with satisfaction for several years. The proportions of the sulphate of iron and phosphate of soda as given in the B. P. may be retained; but instead of one ounce of acetate of soda, about half that quantity of bicarbonate of soda must be used. A better form is that of Mr. Howie :—

Sulphate of Iron	7½ parts.
Phosphate of Soda	6½ ,,
Bicarbonate of Soda	1½ ,,

Dissolve the sulphate in ten times its weight of water, which has been previously boiled, in order to expel air; and the phosphate of soda in a like quantity, similarly treated. Let the solutions cool to between 100° to 135° Fahr., and pour the phosphate very gradually into the iron, with constant stirring. Add the bicarbonate, either in powder or solution. Let the precipitate subside; decant; wash well with previously boiled water; collect on a filter and squeeze out as much water as possible, either with the hand or an ordinary press. These details of manipulation must be rigidly adhered to—more especially those relating to the order of mixing and temperature—or uniform results cannot be obtained. If, in the above formula, the *parts* be held to indicate *drams*, it may be read as part of Parrish's receipt for the so-called chemical food, published in his "Practical Pharmacy," p. 425, and the iron strength of the resulting preparation will accord with the compound sold as genuine.

Sugar.—Some English writers have enlarged considerably on the importance of obtaining pure cane sugar. It is said that beet sugar is very abundant in the English and French markets, and is largely substituted for that of the cane. The selection of a pure article is a matter of prime importance, as many of the pharmacist's troubles relating to the fermentation and precipitation of syrups are referable to impurities in the sugar.

The Administration of Kousso. Dr. Corre. (*Bull. de Therap.*, 1876, 556.) The following method is intended to bring kousso into such a pharmaceutical shape, that while its properties as a tænicide remain unimpaired, it may be administered without repugnance.

Treat 25 grams of powdered kousso with 40 grams of hot castor oil, and afterwards with 50 grams of boiling water, by displacement; express, and combine the two percolates into an emulsion by means of yolk of egg, and add 40 drops of sulphuric ether. It may be sweetened with syrup and aromatised to taste. This is taken at one dose early in the morning. The worm is expelled during the third or fourth evacuation, after about six or eight hours.

Aqua Laurocerasi. A. Ripping. (*Archiv der Pharm.*, Dec., 1876.) The great difference in the effects of different samples of the commercial water led the author to suspect that much of it was prepared artificially; in order to examine the subject he prepared some himself. From his own experiments he had previously ascertained that each litre of the natural distilled cherry-laurel water contained about three grams of essential oil. Having prepared some dilute hydrocyanic acid, of the strength required by the Pharmacopœia for cherry-laurel water (1 in 1000), he added to each litre three grams of oil of bitter almonds, and obtained a mixture which appeared to be identical with the natural water. To distinguish between the two waters, the process of Mohr for distinguishing between natural and artificial bitter-almond water may be employed; namely, silver nitrate, which produces only a slight opalescence in the natural water, as the hydrocyanic acid is wholly fixed by benzaldehyde, and the opalescence is caused by ammonium cyanide, which is formed during the distillation by the splitting up of the hydrocyanic acid into ammonia and formic acid. The presence of nitrobenzol may be recognised, according to Hager, by shaking the water with chloroform, evaporating the latter, treating the residue with alcohol and water, and then adding zinc, hydrochloric acid, and after a while a small piece of potassium chlorate. If no change of colour takes place, the absence of nitrobenzol is proved, as the latter would be converted by nascent hydrogen into anilin, which would be changed to rosanilin by potassium chlorate, and would tinge the alcoholic liquid rose red.

Benzoic Acid as an Antiseptic. H. Trimble. (Abstract from an inaugural essay: *Amer. Journ. Pharm.*, Aug., 1876, 347.) For the purpose of investigating this property, claimed for benzoic acid, two samples were employed: one obtained by sublimation, according to the U. S. P. process, and the other purchased under the name of "artificial" benzoic acid, supposed to have been prepared from hippuric acid. A good commercial salicylic acid was also procured, which, with the above-mentioned samples, formed the basis of the following experiments, in one half of which both the sublimed and artificial benzoic acids were used, and found to be identical in antiseptic power; the remaining experiments were therefore made with the artificial acid only. The results of the writer are condensed in the following table:—

One part of	2000 parts Infusion Buchu	4000 parts Infusion Buchu	8000 parts Infusion Buchu	2000 parts Infusion Colombo	2000 parts Infusion Gentian. simpl.	1000 parts Solution of Albumen [1 in 16 water]	4000 parts Solution of Albumen [1 in 16 water]
Salicylic acid	Spoiled in 8 days	Spoiled in 4 days	—	Spoiled in 6 days	Spoiled in 19 days	Spoiled in 12 days	Spoiled in 10 days
Benzoic acid	Remained unaltered after 60 days	Spoiled in 16 days	Spoiled in 5 days	Cloudy, but no change of colour in 16 days	Unaltered after 30 days	Unaltered after 60 days	Spoiled in 19 days

To ascertain the power of salicylic and benzoic acids to arrest decomposition, they were each added in proportion of one part to 2000 of separate portions of cider which had commenced to ferment. In both cases the fermentation, after twenty-four hours, had entirely ceased, and both were perfectly sweet at the end of fifty days, without the appearance of any further decomposition, a rather curious precipitate having separated at the bottom of each.

It must be remembered that the infusions in the above experiments, without the addition of an antiseptic, would have commenced to decompose in about twenty-four hours, and the solution of albumen in about forty-eight hours. In all cases the operations were conducted in a moderately warm place, so as to favour a change as rapidly as possible.

Having carefully compared the above experiments and their results, the following conclusions are submitted:—

1. That benzoic acid, sublimed or artificial, possesses valuable antiseptic properties.

2. It has the power to arrest decomposition.

3. Tannic acid (of buchu?) does not interfere with its preservative properties.

4. As an antiseptic, it is superior, in many, if not in all cases, to salicylic acid. It also has the advantages of being more readily obtained in a state of purity, of being more soluble, and having a lower commercial value.

Chrysophanic Acid Ointment. B. Squire. (*Pharm. Journ.*, 3rd series, vii., 489.) The author has employed goa powder as an application in various cutaneous affections, and has come to the conclusion that chrysophanic acid, which is the chief ingredient, is also the active agent of this drug. The favourite mode of applying goa in the tropics seems to be to wet the powder with water, or with vinegar or lemon juice, and to smear the thin paste thus produced on the affected skin. But this paste dries up very speedily into its original condition of fine dry powder, which is easily rubbed off by the slightest touch. According to the author, an ointment is unquestionably a much better form of applying the remedy. This form seems occasionally to have been had recourse to; but wetting the powder and smearing on the paste is obviously the orthodox custom. As an ointment should be perfectly smooth and uniform, especial care was taken to obtain this end; and for this purpose advantage was taken of the solubility of chrysophanic acid in hot benzol, which is also capable of dissolving lard. Two drams of chrysophanic acid and an ounce of lard were dissolved in the smallest necessary quantity of boiling benzol, applying heat by a water bath. Then as the brown solution cooled (the vessel containing it being placed in cold water), and the chrysophanic acid, much less soluble in cold than in hot benzol (*Attfield*), became rapidly deposited, the mixture was briskly stirred in an evaporating basin. As the mixture speedily became " set," a most perfect ointment was produced in a very ready manner. After leaving the ointment spread about the dish for a short time, the benzol almost completely evaporated from it, leaving it quite hard, and giving it the appearance of being stained, or some sort of soft, yellowish wax. The smell of benzol adheres to the ointment for some time, but finally is lost, or may be concealed by some essential oil.

The writer finds that the properties of chrysophanic acid are by no means confined to its being a remedy for ringworm, but that it is likely to prove a valuable addition to the list of drugs as a remedy for other non-parasitic skin diseases. He has obtained unquestionably good results with it in the treatment of psoriasis, and it is a serviceable application in cases of lupus. He adds that particular care must be taken in the preparation of the ointment if it is to turn out such as described above. In the first place the acid must be thoroughly dissolved in the hot benzol, and in the next place, the cooling and evaporation of the benzol must be conducted as rapidly as possible. With this view the process of dissolving may be conducted in a small glass beaker, placed in a water bath, and when solution of the acid and the lard has been perfectly accomplished, the solution should be promptly turned into a cold evaporating dish, placed in cold water, and immediately briskly stirred with a glass rod until the solution has become fully and firmly "set."

In a subsequent number of the same journal we find a communication by Dr. H. R. Crocker, who states that he used chrysophanic acid ointment some nine months previously in the treatment of ringworm. The acid was prepared by Mr. A. W. Gerrard, and was employed in the form of a concentrated solution in benzol, which retains about ten grains to the fluid ounce when cold, as well as in the form of ointment, made with ten to forty grains of the acid to the ounce of lard. The results of his experiments, which were limited to parasitic diseases, led him to consider chrysophanic acid as by no means deserving of unqualified praise. Mr. Gerrard, in the same paper, adds the statement that vaseline is a much better solvent of the acid than ordinary fats, and that the use of benzol in the preparation of the ointment is not at all necessary. Hot fats or oils, indeed, appear to dissolve chrysophanic acid in almost all proportions; but on cooling, a good deal of it separates again, and it is necessary to rub it assiduously during the cooling in order to obtain a smooth mass. Mr. A. W. Postans recommends the addition of a few drops of otto of roses to disguise the peculiar odour, and also states that Dr. Ashburton Thompson has pushed the matter even further, by administering goa powder and chrysophanic acid to his patients internally as well as externally.

The botanic source of goa powder is expected, according to Mr. Postans, to be determined by means of a specimen plant, growing at present in the Royal Botanic Gardens, Edinburgh, and supposed to be the source of the drug.

Glycerole of Phosphorus. C. Ménière. (*Répert. de Pharm.*, 1877, 354.) In preparing this glycerole in the usual way, by dissolving phosphorus in heated glycerin, a portion of the phosphorus not unfrequently separates on cooling, giving rise to an opalescence and subsequently to a deposit. This, according to the author, may be prevented by employing phosphorus in a finely divided condition, such as is obtained by mixing it with sugar or gum arabic, either of which is soluble in glycerin. The powdered sugar or gum is mixed with a small quantity of glycerin, so as to yield a mixture of the consistence of honey. This is heated on a water bath, the phosphorus incorporated with it, and the remainder of the glycerin then added in small quantities at a time, care being taken that the temperature never rises above 50° C.

According to Reveil's formula, which the author considers the best, the preparation should contain ·10 gram of phosphorus in 1000 grams. This is ten times weaker than the preparation made according to Dorvault's formula; but in this dilution the same dose of phosphorus is much more readily borne by the stomach.

Chloral with Solid Fats. (*New Remedies*, January, 1877.) An anonymous writer in the *Med. and Surg. Rep.* says, as a therapeutic agent, chloral has become so popular that its range of application is as diversified as any drug or chemical of a century's standing; but its nature has not been sufficiently studied to construct formulæ readily that furnish preparations easily dispensed and always praiseworthy. On the contrary, formulæ are written which furnish not only inelegant, but almost incompatible preparations. A case in point is its combination with solid fats. It is a matter oftentimes overlooked, if not entirely unknown, that chloral hydrate is a solvent for fats; so much so that solid fats become liquefied by contact. Hence it is not advisable to prescribe chloral with lard, simple ointment, or even with simple cerate, in a very large proportion. With oleum theobromæ it forms an unctuous mass, which furnishes a very creditable preparation dispensed as an ointment; but to make from this combination a suppository, is almost an impossibility. Still less possible is it to make a suppository containing with chloral one of the solid extracts which must previously be moistened with a little water to make it miscible with the solid fat, as a drop of water increases enormously the fluidity of the oleaginous mixture. The writer has made a number of experiments as to the best excipients, and finds that equal parts of spermaceti and oleum theobromæ have the advantage over any other. In a suppository containing ten to twelve grains of chloral this is about the proper proportion. Deviating from this strength, the proportion of spermaceti must be increased or diminished accordingly. Vaseline and paraffin, using three of the former to two of the latter, make a very good base, but it does not melt as nicely into an unctuous mass as does the former.

Phosphorus Pills. E. J. Appleby. (*Pharm. Journ.*, 3rd series, vii., 289.) The author has tried cacao butter, balsam of tolu, and common resin as excipients for phosphorus, and finds that with the first named the mass requires some time and patience to prepare, and must be divided into pills and coated at once. The phosphorized tolu balsam is difficult to incorporate with other ingredients, and pills made from it soon lose their shape, and are with difficulty soluble in water. Phosphorized resin, on the contrary, is easily prepared, and may be kept under water for any length of time. It can be quickly reduced to a fine powder, and easily made into a pill mass.

Pills properly prepared with the resin are thoroughly disintegrated by cold water in a very short time. As a very small portion only of the resin is required for an ordinary dose of phosphorus, other ingredients may be combined with it without making too large a pill.

Detection of Adulteration in Oleum Theobromæ. G. Ramsperger. (*Proc. Amer. Pharm. Assoc.*, 1876.) Of all tests used by the author, ether was found to be the best. It indicated all admixtures which he had made to the cacao butter (with the exception of ox-marrow) either directly by the turbidity of the solution of one part of the adulterated cacao butter in two parts of the ether (as is the case with the adulterations by tallow, beeswax, and barberry wax, and paraffin); or if not immediately after solution, then by becoming turbid after standing for some time, and by forming little crystals and grains by spontaneous evaporation of the solution, which crystals are not soluble again in two parts of ether at common temperature (this is the case with Japan wax and spermaceti, with or without the addition of ox-marrow). Anilin shows adulterations with tallow and wax almost as well as ether. Other solvents of cacao butter cannot be used as tests; all the different fats and wax being easily soluble in them, with the exception of barberry wax, which makes a clear solution only with chloroform.

Next to ether and aniline the taste seems to be the most reliable test. The droppings on hot iron, or burning the mixtures with wicks, does not show plainly enough an adulteration with 25 per cent. of tallow; and of freshly rendered beef tallow, even 50 per cent. could be hardly recognised. With Klencke's test the author did not succeed; he was very seldom able to see any difference in the shape of the drops of cacao butter from that of tallow or ox-marrow drops on water; the former expanding dish-like over the surface of the warm water about as much as the latter.

The specific gravity is unreliable. The same seems to be the case with the point of fusibility as a test; at least he found that recently-melted and re-congealed cacao butter melts at a temperature several degrees lower than such as had been melted several weeks before. This may account for the conflicting statements about this point. Guided by the result of the experiments made, the author examined a dozen specimens of oleum theobromæ which he had collected in different wholesale and retail stores. The result was as follows:—

No.	Specific Gravity.	Melting Point.	Test.	Solution in Ether or Anilin.
1	0·850	31° C.	Pure	Clear
2	0·897	33° C.	Pure	Clear
3	0·900	31° C.	A little rancid	Clear
4	0·874	30° C.	Pure	Clear
5	0·976	34° C.	Not quite pure	Turbid
6	0·938	32° C.	Pure	Clear
7	0·979	34° C.	Very little rancid	Clear
8	0·875	34° C.	Strongly rancid	Very turbid
9	0·978	30° C.	Pure	Clear
10	0·872	35° C.	Pure	Very little turbid
11	0·919	33° C.	Pure	Clear
12	0·959	30° C.	Rancid	Clear

This shows two or three adulterations among the dozen, one of them with tallow plainly recognisable.

A New Mode of making Grey Powder. A. Bottle. (*Pharm. Journ.*, 3rd series, vii., 469.) The author discusses the question whether grey powder depends for its efficacy on the impalpably minute division of the mercury, or on the presence of oxides, and arrives at the conclusion that the use of a powder containing mercury in the higher state of oxidation ought to be avoided, and that it is desirable to have *Hyd. c. Cretâ* prepared at intervals not too far apart. He suggests a slight deviation from the British Pharmacopœia process, to the extent of substituting for the slow process of trituration in a porcelain mortar, active agitation in a wide-mouthed glass bottle, by which means the B. P. may be prepared and the metal minutely sub-divided with an expenditure of very little, if any, more time and labour than is required to be devoted to the preparation of a tincture.

The Use of Petroleum Benzin in Pharmacy. L. Wolff. (*Amer. Journ. Pharm.*, January, 1877, 1.) Petroleum benzin has been frequently proposed and variously experimented with by different operators, with the view of its substitution for the much higher priced ether in preparing oleo resins, and has been repeatedly found not to answer the purpose intended for it. Although its valuable solvent powers for fatty matter, wax, and essential oils cannot be disputed, it fails to extract the resins and the active ingredients, which are of the utmost importance in oleo resins. Ginger treated with benzin yields an oil containing all the odoriferous properties thereof, but extracting none of the pungent tasting resin for the remedial properties of which it is justly celebrated, and which subsequent to the benzin process is readily dissolved from it by ether or alcohol. Buchu under a like treatment, as reported by another contributor of this journal on this subject, gives an oily substance devoid of the diuretic properties of the leaves, though possessing their specific odour. Cubebs, though completely exhausted by it of its fixed and essential oils, fails to yield its cubebic acid to it; black pepper its piperin; and wormseed its resin and santonin. But all the substances mentioned, and many more which have been subjected to the same process, are readily deprived of their fixed and essential oils, leaving them inodorous, seemingly dry and incoherent powders, that are, if treated with alcohol, ether, or chloroform, readily deprived of their resins, thus affording a method for obtaining them separate from wax, fixed, and essential oils.

Its extraordinary solvency for essential oils destines benzin for an important place in pharmacy; and oils derived by its aid from cinnamon, cloves, and other drugs are, if their odour is any indication of their value, if not superior, certainly not inferior, to the distilled oils of these articles.

The oils obtained by exhaustion with benzin and its subsequent evaporation are mixed with wax and fixed oils to some extent, which can easily be separated therefrom by dissolving in alcohol, in which the latter are insoluble, filtration of this solution, and either expulsion of the alcohol by evaporation at the moderate heat of a water bath or, much safer and better, by mixing the filtered alcoholic solution with several times its bulk of water, when the essential oil will rise to the surface or subside beneath it, as its specific gravity may be.

The oils by this cold process have a beautiful aroma, superior to many of the distilled ones; and the easy manner of obtaining them may, without doubt, prove a valuable method for the pharmacist, who cannot always procure in the market the oils he wants, and has no facilities for distilling them, besides giving him fair means to arrive at a quantitative estimate of the essential oil contained in an article under analysis.

The essential oil of parsley seed cannot thus be separately prepared by the aid of benzin, as it contains another peculiar oily substance, well known by the name of "apiol," which is soluble both in benzin and in alcohol.

A great deal of the apiol in the market, both in bulk and in capsules, is nothing more than an oleo resin of parsley seed, which can lay no claim whatever to its name, being of green colour, insoluble to a large extent in alcohol, and congealing at ordinary winter temperature; all of which properties "true apiol" does not possess. Apiol has come into extensive use of late years, secured high praise as an emmenagogue, and is also claimed by its discoverers to be an antiperiodic but little, if any, inferior to quinia; but its high price, due to the expensive process as proposed by Messrs. Loret & Homelle, perhaps more than anything else, prevents its general introduction.

Powdered parsley seed, exhausted with benzin, and the liquid spontaneously evaporated, yields a mixture containing principally fixed oil, wax, and apiol; the latter, alone, being soluble in alcohol, can readily be recovered therefrom by repeated washings in stronger alcohol. The washings, evaporated over the water bath with a gentle heat, leave as residue "true apiol," corresponding in every respect with the article sold under the name of "Joret & Momolle's," having the advantage of its low price making it accessible to persons of limited means as well as to the more favoured by fortune, especially if it is not dispensed in capsules, for which there is no occasion, since it may be given dissolved in essence of peppermint, or in emulsion, disguised by the oil of the same name. Samples of "apiol" prepared in this manner have been tried by several prominent physicians in their practice, and were pronounced to be equally as efficient as the imported French article. Quite frequently the fixed oils much encumber the result of pharmaceutical operations, as is prominently the case in preparing the "Alcoholic Extract of Nux Vomica," which has often been noticed and given attention to by many writers. (See *American Journ. Pharm.*, 1874, p. 405; also, Professor Procter on the same.) Nux vomica, if exhausted with benzin, yields a large percentage of a clear fixed oil, congealing at ordinary winter temperature; and the powder, if subsequently treated in the usual manner with stronger alcohol, gives an extract which offers no trouble by proper evaporation in reducing it to the dry state. The oil derived from the benzin exhaust, to make sure of not losing any strychnia or brucia that may be contained therein, should be repeatedly shaken with dilute alcohol until the washings fail to betray to the palate the specific bitter taste of their alkaloids; then the washings must be mixed with the extract in course of evaporation, and the whole reduced to proper consistency. By the ordinary way, the separation of the oil from the extract is at best a tedious matter, causing the loss of extract, and is never completely performed, thus preventing evaporation to dryness, which by the benzin process is readily effected.

Another article, which the pharmacist has frequently to purchase at an exorbitant price, is "purified oleic acid," which has been much used of late in making the oleates now in use, and can be easily and at small expense prepared, with benzin as solvent, in the following way:—

Oil of sweet almonds, saponified with caustic potash and the soap decomposed with tartaric acid, is washed with hot water to separate the precipitated bitartrate of potassium from the mixture of oleic and palmitic acids. These are combined with litharge, forming the oleo-margarate of lead, from which the benzin dissolves the oleate of lead, leaving as residue the undissolved palmitate thereof. From the benzin solution the lead is precipitated by dilute hydrochloric acid in form of chloride of lead; and on evaporation of the benzin, "oleic acid" will remain, sufficiently pure for pharmaceutical purposes, giving clear and permanent solutions with the red and yellow mercurial oxides, as high as thirty per cent. if necessary.

As crude commercial oleic acid can be bought at very low figures, it may be purified by combining it with litharge, deriving from it the oleate of lead, from which again, by the aid of benzin, the purified oleate can be separated, and as before stated, purified oleic acid prepared at but a small expense.

To gain the same end, the simplest way perhaps is to utilize the ready-made oleo-palmitate of lead, the officinal lead plaster, dissolve it in benzin, and extract from it the oleic acid by precipitating the lead by aid of hydrochloric acid.

Oleic acid thus prepared has been used for some time, and found to answer better for the preparation of the oleates than the article sold by some of the manufacturing chemists.

The above results by no means limit the utility of petroleum benzin as a solvent and important pharmaceutical factor; but they will show that this refuse article, of comparative little commercial value, which has been applied to but little more than the removal of oil, grease, or paint stains, may be turned to good account by its very deficiency to act like ether or similar substances as a general solvent for both fats and resins.

The Union of Chloral Hydrate and Camphor. E. C. Saunders. (*Pharm. Journ.*, 3rd series, vii., 89.) The author quotes a number of experiments, the results of which indicate that no chemical action takes place when chloral hydrate and camphor are mixed in the cold. Both are volatile at ordinary temperatures; and the following experiment, which was performed to ascertain which was the solvent, conclusively proves that it is the vapours which act upon each other. Two lumps, one of chloral hydrate and one of camphor, were placed about an inch apart on a porcelain plate, and covered with a bell glass. In fifteen minutes the surface of the camphor was quite damp, but the chloral was quite dry. In three hours the chloral was still dry, while the camphor was quite wet and standing in the midst of liquid. In twelve hours the liquid had reached the chloral, the upper surface of which was still dry, while in twenty hours both lumps were half liquefied, and the inner surface of the bell glass was covered with moisture. This would almost seem to point out that the vapour of the chloral was the solvent; but it was found while one part of camphor would form a permanent liquid with three and a half parts of chloral hydrate, one part of chloral dissolved by the aid of heat, with two parts of camphor solidified to a soft crystalline mass when cold, from the camphor crystallizing. It is most probable that the camphor is the solvent, which would also seem likely, as camphor is an essential oil, and is known to render other bodies fluid. The change of colour, with the formation of an oily liquid, would seem to point to chemical action occurring when the mixture is subjected to strong heat.

The following notes of the solubility of the mixture in various fluids may be serviceable to any who are called upon to dispense it, or to physicians who feel inclined to try the effects of it.

It is miscible in all proportions with alcohol, sp. gr. ·838, bisulphide of carbon, ether, and olive oil. It is soluble in eleven parts of alcohol, sp. gr. ·937. It is insoluble in water. It forms a clear mixture with one and a half parts of chloroform, but a further addition of three parts of chloroform renders it turbid. Camphor forms a permanent liquid with three times its weight of chloral hydrate. The experiments were conducted with the atmosphere at a temperature of about 80°; the fact is mentioned, as it may have influenced the solubility slightly.

Glycerole of Nitrate of Bismuth. B. Squire. (*Pharm. Journ.*, 3rd series, vii., 389.) Desiring to employ a solution of a simple bismuth salt in certain skin diseases, the author tried glycerin as a solvent, and found that the nitrate was *freely soluble* in glycerin, and that it dissolved without decomposition. This solution may even be diluted with water without depositing any more than a trifle of the salt for nearly an hour.

With the view of studying the reactions of this glycerole, Mr. John Williams prepared some of it by dissolving 20 per cent. of crystallized nitrate of bismuth in Price's glycerin (*Pharm. Journ.*, 3rd series, vii., 470). He found the solution is best effected in the cold; if much heat is employed in the preparation, the glycerole when diluted does not give a clear solution but a milky one, at any rate at the end of a few hours. The property of bearing dilution with water without producing a turbid solution, appears to diminish by keeping. The diluted solution does not bear boiling, but when so treated deposits a basic salt not afterwards soluble in water. Caustic potash (or soda), added to the glycerole diluted with water, first causes a white precipitate, which is, however, perfectly soluble in an excess of the alkali, a bright clear liquid being produced, which is perfectly miscible with water in all proportions, and might possibly be employed medicinally as a substitute for the *liq. bismuthi ammonio-citratis* of the Pharmacopœia. From this reaction Mr. Williams is inclined to infer that the glycerole is not a mere solution of the nitrate of bismuth in glycerin, but is a chemical combination; and that the glycerin is playing a part somewhat similar to that taken by the citric acid in the liquor of the Pharmacopœia. Ammonia, however, cannot be substituted for potash in this reaction, no excess of the former making a clear solution, although a trace of bismuth is held in solution, as can be proved by adding sulphate of ammonium to the filtrate.

Mr. Williams' opinion that this preparation is a real chemical combination is not shared by Mr. W. Willmott, who regards the difference between the behaviour of ammonia and potash in this reaction as an indication that the glycerin here merely acts as a solvent, but does not form a chemical compound (*Pharm. Journ.*, 3rd series, vii., 830.) The same writer suggests the following formula for this preparation:—

Nitrate of Bismuth	℥ss.
Distilled Water	ʒij.
Price's Glycerin	ad ℥vj.

Dissolve the nitrate of bismuth in two fluid drams of the glycerin previously mixed with the distilled water; then add the solution to the remainder of the glycerin, and mix well together.

This is prepared *at once* and without the slightest difficulty. It contains five grains of the active ingredients in each fluid dram, and is most convenient for prescribing. Even therapeutically the addition of the water is an advantage, since, as in the cases of tannin and borax, the density of the undiluted glycerin prevents the action of the remedy from coming readily into play. It is better in each case to dilute with a little water before using.

Administration of Oils and Oleo-Resins by means of Wafer Capsules. S. Limousin. (*Répert. de Pharm.*, 1877, 257.) The author suggests the use of *cachets de pain*, or wafer capsules, as vehicles for administering castor oil, cod liver oil, copaiba, and other liquids which do not act upon the substance of the wafer. The two empty halves of the capsules are united in the usual manner, except on one portion of the rim, thus leaving an opening through which the oil is introduced by means of a pipette. The orifice is then closed by moistening it. The oil may also be placed in the cavity of the lower wafer, and the upper one rapidly affixed to it before the oil has had time to spread to the margin. Cod liver oil communicates its odour to the capsule unless the inner surface of the wafer be previously covered with collodion.

Canada Balsam as an Excipient for Pills. M. Dauncey. (*L'Union Pharmaceutique*, 1877, 168.) To prevent pills from becoming hard and insoluble, the author suggests a mixture of one part of wax and three parts of Canada balsam. This mixture possesses the property, even if added in small proportion, of binding together the component parts of pill masses, of keeping the pills permanently soft and yet sufficiently solid to prevent them from flattening, and of preventing deliquescent constituents from attracting moisture. He has prepared, by means of this excipient, pills of potassium acetate containing three grains of the latter in each pill, and remaining entirely unaltered on keeping. Pills prepared in this manner readily disintegrate in the stomach.

Oleate of Bismuth. S. C. Betty. (*Pharm. Journ.*, 3rd series vii., 469.) Having noted the power of oleic acid in dissolving oxide of bismuth to a considerable extent, the author suggests the following formula for such a combination :—The oxide of bismuth, B. P. (the trisnitrate and carbonate being useless for this purpose), is ground very fine, and the oleic acid gradually incorporated with it. The mixture being placed in a suitable vessel is subjected to a temperature of nearly its boiling point; then allowed to digest, with frequent agitation, at a temperature of about 60° during four days, or until it solidifies. The result is pharmaceutically a plaster; chemically, an oleate of bismuth, containing 20 per cent. of the base. Respecting its utility as an endermic application, it is stated that the preparation melts readily in contact with the skin, is bland to an excoriated surface, and penetrating by its limpidity.

Ferric Citrophosphate. R. Rother. (*Pharmacist*, Sept., 1876.) Citric acid is one of the most remarkable of the organic acids. Its constitution is so peculiar and unintelligible that synthetic chemistry has failed to produce it; neither has any process of disruption yielded it from more complicated compounds. It is, in our present knowledge of the substance, most emphatically an organic acid. It is, however, a noticeable fact that, considering the interest and importance attaching to the citrates as a class, they have been but imperfectly studied. The marvellous property possessed by citric acid of rendering metallic bases insusceptible to many of the ordinary reagents has long been known. This action has been interpreted in various ways, and given rise to some of the most striking theoretical speculations. From the time that H. Rose first observed the ready solubility of dry ferric citrate in presence of normal monad citrates to the present, no definite and reliable knowledge existed in regard to the constitution of these compounds. The opinion largely prevailed that they were but mechanical mixtures; that is, mere solutions of one salt in the other, without reference to equivalency. The first step in the direction of a comprehensive view of this heretofore hopelessly intricate subject was made by the writer (*Laboratory*, Feb., 1876), in showing that ferric salts with monobasic radicals formed, by a combination of double decomposition and additive affinity, a peculiar green double citrate of iron and the monad metal, whilst the monobasic or dibasic radical passed to the base of the citrate actually decomposed. By means of dialytic experiments (*American Journal of Pharmacy*, April, 1876) the writer added further proof in confirmation of this result, but also showed that in case of the citrophosphoric compounds a rearrangement of more complicated character takes place.

All compound salts may be divided into two classes. Double, triple, and quadruple salts are formed from dibasic, tribasic, and tetrabasic acids when each individual unit of equivalency is saturated by a distinct basic radical. Secondary, tertiary, and quaternary salts are produced when each independent unit equivalency of a polyatomic metal is saturated by distinct acid radicals of corresponding basicity.

The writer's process for preparing ammonio-ferric citrophosphate (*Pharmacist*, August, 1871) indicates that two equivalents of ferric orthophosphate and one equivalent of triammonic citrate react upon each other in the production of a soluble amorphous compound readily obtainable in splendid brown-green scales. The solution, when subject to dialysis, gave no evidence of dissociation, showing that no crystallizable salt is present. The formation of the compound, therefore, determines a basic condition made apparent by the presence of ferric oxycitrate or free ferric hydrate (*Pharmacist*, May, 1876). Its generation may then be represented as follows:—

$$4\,(Fe\,P\,O_4) + 2\,(N\,H_4)_3\,C_6\,H_5\,O_7 + 3\,(O\,H_2) = Fe\,C_6\,H_5\,O_7\,(N\,H_4) + C_6\,H_5\,O_7.\,Fe\,(O\,H)_3 + 2\,(Fe\,P\,O_4).\,(N\,H_4)_3\,H_3\,(P\,O_4)_2.$$

As this reaction assumes the production of an ammonio-ferric phosphate in which one equivalent each of monammonic and diammonic phosphate are seemingly united, the writer endeavoured to produce this double phosphate independent of the citrate by dissolving freshly precipitated ferric phosphate in a mixture of the two ammonium phosphates, but no solution appeared to take place. Ferric citrate was then substituted for the ammonium phosphates, when rapid solution was effected, thus enabling the writer to add one more interesting iron salt to the list of those already discovered by him. The ferric citrophosphate obtained by this combination is a secondary anhydrous salt, having the composition $Fe_2\,(P\,O_4)\,(C_6\,H_5\,O_7)$, and easily obtainable in beautiful brown-green scales. It forms in long slender blades, a shape characteristic of ferric citrate. In concentrated solution it is absolutely permanent, showing also, in this respect, one of the properties of ferric citrate. It has a sweet, acidulous taste, free from metallic flavour and the saline nauseousness of some of the ferric double citrates now in use. There can be no doubt of its complete superiority over all other citroferric phosphates at present so largely employed, either in a pharmacal or therapeutic aspect. On the assumption that this salt is one of the components of the ammonio-ferric citrophosphate above described, the formation may be written as follows:—

$$2\,(Fe\,P\,O_4) + (N\,H_4)_3\,C_6\,H_5\,O_7 = Fe_2\,(P\,O_4)\,(C_6\,H_5\,O_7) + (N\,H_4)_3\,P\,O_4.$$

This result seems quite probable, since, as the basicity of the acids is apparently alike, a possibility of closer union is not precluded, and hence we may have the actual combination of the two constituents in the condition of a secondary double salt.

It is a remarkable fact, worthy of note in this connection, that ferric pyrophosphate is practically insoluble in ferric citrate. This property, therefore, supports the writer's constitutional formula of the officinal pyrophosphate, making it a mixture of ammonio-ferric pyrophosphate, ammonio-ferric citrate, and free ferric citrate.

As previously suggested by the writer (*American Journal of*

Pharmacy, April, 1876), it was found that the most practical and expeditious process of preparing the ferric citrophosphate consisted in precipitating the iron as a mixed phosphate and oxycarbonate, and dissolving the mixture in citric acid. Ferric oxycarbonate (*Pharmacist*, Dec., 1873) is so incomparably superior in every respect to the ordinary ferric hydrate that no operator who has once employed it will ever abandon its use. The compact ferric phosphate (*Pharmacist*, Dec., 1873,) is equally an improvement on the gelatinous kind. In the production of ferric citrophosphate the writer combined the processes of the two iron salts as follows:—

Solution of Ferric Sulphate . .	one pint.
Disodic Orthophosphate, Cryst. . .	7 troy ozs.
Disodic Carbonate, Cryst. . . .	9 ,, ,,
Citric Acid, Cryst.	3 ,, ,,
Water	sufficient.

Add the sodic phosphate to the solution of ferric sulphate, and apply heat until solution is effected; now place the sodic carbonate into a capacious vessel, pour on half a pint of water, and apply heat until the salt has dissolved; then add in rapid succession the former solution, one-fourth at a time, and maintain the heat, with constant stirring, until effervescence has ceased; dilute the mixture with water to the measure of eight pints, and when the precipitate has perfectly subsided decant the supernatant liquid, and mix the sediment again with a fresh portion of water, as before; after three or four washings in this manner, pour the precipitate upon a muslin strainer and press it thoroughly; place the residue in a porcelain capsule, add the citric acid and apply a water bath heat until perfect solution has occurred; finally, pour the liquid upon plates of glass or porcelain, and expose it in the open air to dry. The yield is about 6½ troy ounces.

In this formula a slight excess of sodic phosphate is employed, since the sodium carbonate has a tendency to take away the acid of the ferric phosphate. Hence, the two precipitates may also be prepared separately, mixed after washing, and dissolved as above. With the adjusted quantity of sodium phosphate, as directed in the above formula, the final result, however, agrees very closely with the theoretical yield.

If desirable, the salt may be retained in solution, which, if sufficiently concentrated, will remain absolutely permanent. A solution containing one-half a troy ounce of the salt in the fluid ounce appears to be the most convenient form.

This salt, similar to the officinal pyrophosphate, when mixed with any acid stronger than the citric, is completely decomposed, ferric phosphate being precipitated. The officinal pyrophosphate, when mixed with orthophosphoric, pyrophosphoric, metaphosphoric, chlorhydric, nitric or sulphuric acid, is instantly precipitated.

The white gelatinous precipitate is insoluble in either of the phosphoric acids, but any of the latter three acids, when in sufficient excess, again dissolve it. The erroneous belief is still abroad that the officinal pyrophosphate of iron should form a clear solution when mixed with diluted phosphoric acid. It is, however, about time now that it was generally understood that any citrophosphoric compound is incompatible with free orthophosphoric acid, by reason of the fact that any citrate present will be decompossd, its acid being liberated; and as free citric acid fails to dissolve the various ferric phosphates, these must of necessity be thrown out of solution.

Pepsin combined with Glycerin. M. Catillon. (*Repért. de Pharm.*, 1877, No. 11.) Glycerin is recommended by the author both for the extraction of pepsin and for its medicinal exhibition. Administered in this form, the pepsin is reported to exercise an increased digestive power, while another advantage is to be found in the fact that a solution of pepsin in glycerin may be kept for a great length of time without suffering any change.

The Spectroscope in Pharmacy. W. Gilmour. (*Pharm. Journ.*, 3rd series, vii., 529–531, and 569–571.) The author has applied the spectroscope to the examination of tinctures and extracts of the following drugs:—aconite, belladonna, bearberry, buchu, Indian hemp, hemlock, foxglove, hops, henbane, lettuce, lobelia, matico, and senna. The report contains many points of interest, but as it is not suited for abstraction, we must refer our readers to the original article.

Valuation of Powdered Ipecacuanha Root and Dover's Powder. T. M. Stewart. (*Amer. Journ. Pharm.*, August, 1876, 359.) All the specimens were obtained from different retail drug stores in Detroit and Jackson, Michigan.

The ipecacuanha was assayed by the process lately recommended by Dragendorff ("Werthbestimmung einiger starkwirkender Droguen" (1874) S. 37), the drug being extracted first by acidulated water, and then by alcohol, the pectin filtered out from the concentrated solution; when the alkaloid is either determined volumetrically by potassium mercuric iodide, or extracted by chloroform or benzin in presence of barium carbonate, and the residue thereof weighed (one c.c. Mayer's solution precipitates 0·0189 gram emetia.) Both volumetric and gravimetric ways were found to give concurring duplicate results, and the two ways gave results corresponding closely with each other; but the volumetric method leaves less danger of loss in operating. Two grams were taken each time.

Powdered Ipecacuanha.

No. 1.	1·75 per cent. emetia.	No. 5.	1·90 per cent. emetia.
,, 2.	1·45 ,, ,,	,, 6.	2·00 ,, ,,
,, 3.	2·10 ,, ,,	,, 7.	1·90 ,, ,,
,, 4.	1·60 ,, ,,	,, 8.	2·05 ,, ,,

Average, 1·84 per cent. emetia.

All the numbers were examined microscopically and chemically for adulterations, especially for almond meal, chalk, and antimonium potassium tartrate; but no adulterations were found, except a little extraneous woody fibre.

The compound powder of ipecacuanha was assayed as follows ("Dragendorff's Werthbestimmung," S. 96). Three grams of the powder were extracted with 85 per cent. alcohol (the residue tests for adulterations); the dry residue from the alcohol dissolved in acidulated (sulphuric acid) water, filtering if necessary, and the narcotine removed by washing the acid solution with ether. After addition of excess of barium carbonate, the solution is now extracted with benzin (several portions), the residue from evaporation of the benzin being weighed as emetia (confirming by dissolving in acid water and titrating with potassium mercuric iodide). The solution exhausted with benzin is washed with amylic alcohol (several portions), and the residue from evaporation of the amylic alcohol weighed as morphia (confirming volumetrically by potassium mercuric iodide after dissolving in acidulated water). The ether and the amylic alcohol should be water washed.

Dover's Powder.

No. 1.	0·20 per cent. emetia,	and 1·03 per cent. morphia.
,, 2.	0·16 ,, ,,	,, 1·00 ,, ,,
,, 3.	0·23 ,, ,,	,, 1·06 ,, ,,
,, 4.	0·20 ,, ,,	,, 1·03 ,, ,,
,, 5.	0·13 ,, ,,	,, 0·93 ,, ,,
,, 6.	0·13 ,, ,,	,, 1·00 ,, ,,
,, 7.	0·26 ,, ,,	,, 1·06 ,, ,,
,, 8.	0·23 ,, ,,	,, 0·96 ,, ,,
Average,	0·19 ,, ,,	,, 1·01 ,, ,,
U. S. P. Standard	,, ,,	,, 1·00 ,, ,,

The average of 0·19 per cent. in Dover's Powder equals 1·90 per cent. emetia in ipecacuanha.

All the samples of Dover's Powder were examined for adulterations, organic and inorganic, but none were found.

Benzol and Benzin. M. Heeren. (*Zeitschrift. des oesterr. Apoth. Ver.*, 1877, 190.) The terms benzol and benzin are so often used indiscriminately, not merely in commercial life, but also in chemical and pharmaceutical literature, that a few observations respecting the various substances which pass by these names may not be out of place.

Benzol, when first discovered by Mitscherlich, was named by him benzin. In its purest condition, as obtained by distillation from a mixture of benzoic acid and lime, it is a colourless liquid having a pleasant odour, a specific gravity of ·878, and a boiling point of 80·5° C.; it is highly inflammable, can be ignited at ordinary temperature, and burns with a luminous, very smoky flame. It does not mix with water, but combines readily and in all proportions with alcohol and fatty oils. It takes up gutta percha in very large proportion, and is also a good solvent for caoutchouc. By concentrated nitric acid it is converted into nitrobenzol, a pale yellow liquid of a pleasant odour, resembling that of the essential oil of bitter almonds. When cooled to 0° C., it solidifies, forming a crystalline mass. The composition of benzol is represented by the formula $C_6 H_6$, and its high percentage of carbon (92·3) fully accounts for the dense black smoke which it emits on burning.

Much cheaper, but also much less pure, is the benzol obtained from coal tar. The very thin liquid known as coal tar oil, which in the distillation of the tar passes over first, yields on purification and redistillation a product consisting principally of benzol, but containing also toluol (a similar but less volatile liquid), besides small quantities of xylol, cumol, cymol, and probably some other less volatile hydrocarbons. For many purposes the presence of these impurities are no disadvantage whatever, and in benzol required in the manufacture of aniline colours the presence of toluol is even an essential condition; but it is only just to insist that such a preparation should be distinguished from pure benzol by its name also, as will be the case if this product be always called benzin, and the name benzol be restricted to the preparation obtained from benzoate of lime.

By repeated fractional distillation, it is possible of course to obtain from coal tar oil a product boiling constantly at 80° C., having a specific gravity of ·88, and crystallizing at 0° C. Such a preparation is now an article of commerce, and has the fullest claim to the name benzol; but the less pure products, which are far more commonly met with, and are sold at a much lower price, should be designated as benzin. They boil at a higher and inconstant temperature, and the determination of the boiling point therefore affords the best means of distinguishing them from pure benzol. Their proper name is benzin.

Wholly different from benzol and benzin, and yet very frequently confounded with them, are the first or most volatile products of the distillation of petroleum. These are mixtures of various hydrocarbons of different boiling points and specific gravities, containing among others the hydrides of butyl, amyl, and capryol. They have a petroleum-like odour, quite different from that of benzol, and, when shaken with an equal volume of alcohol of 90 per cent., they separate, whereas benzol and benzin treated in the same manner, yield perfectly clear and uniform mixtures. Owing to their considerably smaller percentages of carbon, they burn with a much less smoky flame than either benzol or benzin. To prevent confusion, these products ought to be called petroleum benzin, petroleum ether, or benzolin, but not benzin.

The tars obtained from cannel coal, boghead coal, brown coal, peat, and wood, yield mixtures of hydrocarbons known as photogen, mineral oil, shale oil, and eupione, which boil at a much higher temperature than benzol, have an unpleasant odour, do not mix with alcohol of 90 per cent., and burn with a less smoky flame.

The Manufacture of a Cinchona Febrifuge in India. (From *New Remedies*, v., 386.) The cinchona plantations on the Neilghiris yield practically two barks, red bark and crown. Red bark is rich in total alkaloids, but not very rich in quinia, and the latter is difficult of separation. The bark is of comparatively small value, therefore, to the quinine maker, although of great value to the government as a source of supply for a cheap febrifuge. Red bark is also of much value in Europe for making galenical preparations (in other words, it is a good druggist's bark), and recently large prices have been got for consignments bought by druggists. These rates are far beyond the value of the quinia contained in such bark, as estimated by a quinine-maker. It is doubtful whether a European alkaloid-maker could, in fact, work red bark for its alkaloids at their present price, and pay for the bark at the rates recently given in London for Neilghiri-grown produce. Crown bark is, on the other hand, rich in crystallizable quinia, and is nearly as highly valued by the quinine-makers as good American yellow. But red-bark trees are by far the most numerous on the government and other plantations in India and the colonies. This species is hardier, grows better, and yields about one-third more bark than the pale or crown bark. The utilization of red bark by manufacture in India is therefore of the highest importance.

The Sikkim plantation consists of red and yellow bark trees. Yellow bark, which has been a failure in the Neilghiris, promises to be a success there. In character, yellow resembles crown bark, but is even more esteemed by the quinine-makers. As both are easy to work, crown and yellow barks would be very much preferable to red bark as sources for the manufacture in India of a cheap febrifuge, if *officinalis* and *calisaya* trees could be got to grow as luxuriantly as *succirubra.*

As the result of a systematic set of experiments, Mr. J. Broughton, government quinologist at the Neilghiri plantation, decided on issuing as "the cheap febrifuge" wanted for India, a preparation called amorphous quinine, which consisted of the total alkaloids of cinchona bark in the form of a non-crystalline powder, mixed to some extent with the resin and red-colouring matter so abundant in red bark. This alkaloid-mixture was accepted by the medical faculty in the Madras Presidency as a remedy in malarious fever, scarcely, if at all, inferor to quinia. Of these alkaloids about six hundred pounds had been manufactured up to the end of the fiscal year 1872–73, when it was found that, after calculating at its manufacturing value the price of the bark used, Mr. Broughton's product cost more than ordinary commercial quinia. The factory has accordingly been closed, and the bark is to be disposed of otherwise than by local manufacture.

The Sikkim (Himalaya) plantations are younger than those on the Neilghiris. No quinologist was appointed to them until the end of the year 1873, when Mr. C. H. Wood was sent out by the Secretary of State. Actual manufacture did not begin until 1875.

The method at present in operation in the factory in Sikkim is simple in the extreme, and is as follows:—

General Nature of the Process.—The dry bark is crushed into small pieces (but not powdered), and is put into wooden casks, where it is macerated in the cold with very dilute hydrochloric acid. The liquor is then run off into wooden vessels, and mixed with an excess of a strong solution of caustic soda; a precipitate forms, which is collected on calico filters, and well washed with water. The precipitate is then dried at a gentle heat and powdered. It constitutes the *crude febrifuge,* which is next submitted to a process of purification. In the latter process a certain weight of the crude product is dissolved in dilute sulphuric acid, and a small quantity of a solution of sulphur in caustic soda is added to the liquor. After the elapse of twenty-four hours, the liquor is carefully filtered, the filtrate is mixed with the caustic soda, and the resulting precipitate collected on calico, washed with a small quantity of water, dried and powdered; it is then ready for issue, and is sent out under the name of "*Cinchona Febrifuge.*"

Arrangement of the Factory Sheds.—A position was chosen conveniently near the dry bark godowns, and so situated on the side of the hill that a copious supply of water could be obtained at a level with the roof of the sheds in which the maceration is conducted.

These sheds are rough temporary erections, constructed with saplings, and a mat or thatch roof. Down the centre an open drain is cut to carry off the waste liquor. Over this drain some wooden stands are placed, on which the calico filters rest. The filters are formed by tying a square piece of calico to a wooden frame by the four corners. On each side of the shed is placed a row of twenty-one casks, standing on end upon a stand which elevates them about two feet from the ground. They are empty beer-barrels, which have been purchased from the Commissariat Department at Darjeeling, the head removed, and the cask thoroughly cleansed; a hole is cut in the side of the cask at a level with the bottom, and closed with a cork. In front of the casks a row of tubs, formed by cutting beer-barrels in halves, is placed, so that on uncorking the barrels, the liquor will run out into the tubs.

Outside the shed, at one end, are a couple of large wooden vats at such an elevation that liquid can flow from them along a bamboo trough into any one of the barrels in the shed. The capacity of the large vats, up to a mark on the inside near the top, is accurately determined. Water is run into the vat up to the mark, and a certain quantity of muriatic acid is added, and the whole well mixed. This diluted acid can then be run into any one of the casks in a line with the vat, by means of a bamboo trough. In addition to the macerating sheds, there is a small brick building, heated with charcoal, in which the precipitate is dried; also a separate shed in which the process of purification is conducted.

Method of Conducting the Process.—The casks are worked in sets of three, and are marked A B C.

In each shed there are fourteen sets, seven on each side. Each cask receives one maund ($= 37\frac{1}{2}$ kilos.) of dry bark, which undergoes four successive macerations, the liquor being moved in rotation through the three casks. Each maceration lasts half a week. The liquid used for the fourth and last maceration is acidulated water drawn from the vat. When this is run off, it is moved into the next cask to form the third liquor. When this is drawn off, it forms the second liquor for another cask, and, when transferred from that, it goes on to new bark, from which it is drawn off and precipitated. Of course, in starting a new shed, every cask contains dry bark, consequently the system of rotation is not brought into full operation until after the first fortnight; and it is only after the shed has been in operation for three and a half weeks that the liquor for precipitation has been used for four macerations.

The liquor which is to be precipitated is now run into the tubs. The other liquors are drawn into wooden buckets and poured into the proper casks. The new acid is then drawn from the vats. The diluted acid is made in the vat by adding one gallon of muriatic acid to every one hundred gallons of water.

The weight of acid used in the exhaustion is 6½ per cent. of the weight of dry bark. It is obtained from Mr. Waldie's chemical works, at a cost of 3½ annas (8 annas = 1 shilling Engl.) per pound in Calcutta.

To precipitate the saturated liquor, a solution of caustic soda is added in excess. The caustic soda is obtained from England in 5-cwt. drums, costing from £15 to £20 per ton in London. One part of this is dissolved in three parts of water, and the solution stored in iron vessels. The quantity to be added to the bark liquor must be judged of by the appearance produced. When a sufficient quantity has been introduced, the precipitate assumes a somewhat curdy condition.

About 6½ pounds of solid soda are used for every 100 pounds of dry bark.

The filtration is not commenced until the following day, when the liquor is transferred to the calico strainers, which have been well wetted. The first portions that run through are returned, until the liquid passes of a bright ruby colour; it is then allowed to flow away by the drain. After all the liquor has drained off, water is passed through the precipitate until it ceases to acquire a red tint. The alkaloids on the filter should then be of a uniform cream colour. The precipitate is now dried and reduced to a fine powder, which is stored in suitable bins. It constitutes the crude febrifuge.

The Process of Purification.—The precipitate during the act of drying acquires a slightly reddish brown colour. It is therefore submitted to a process of purification. Fourteen gallons of water are mixed with two pints of sulphuric acid, and twenty pounds of the dry powder are introduced. The alkaloids dissolve, and a quantity of colouring matter remains insoluble. About half a pint of a solution of sulphur in caustic soda is now stirred in, and the whole allowed to stand for twenty-four hours. It is then filtered through calico into a clean vessel, care being taken to get the liquor perfectly bright. About six gallons of water are used to wash the sediment left on the filters. The clear filtrate is thoroughly mixed with solution of soda to precipitate the alkaloids; the precipitate is collected on calico, washed with a small quantity of water, drained, dried, and reduced to fine powder; it is then ready for issue.

Wooden tubs are used for this process, but they are not so well suited for the purpose as enamelled iron or earthenware. The purification is conducted in a separate shed by a man who is confined to that work.

The Labour employed.—The only workmen employed in the factory are Nepaulese coolies. When the process is once brought into full operation it is found that these men readily master every detail, and conduct the whole thing with all the care and accuracy that is required. But, of course, the factory is under the supervision of Mr. Gammie, the officer in charge of the plantation, who visits it once a day, and sees that the work is being properly performed.

The Bark used.—Dry *succirubra* bark only is employed. Moreover, care is taken to mix the root, stem, and branch bark together in as nearly as possible the proportions in which they are yielded by the plantations. This mixture is broken into small pieces, and a maund of it goes into each cask. This is done to insure uniformity of composition in the product. Green bark is never operated on. It will be seen that the arrangement of the process requires that a certain weight of bark should be put into the casks every week throughout the year. This could not be done with green bark, because bark is only taken from the trees twice per annum. Apart from this, however, it has been found that dry bark yields a much better product, and quite as large a quantity. The small cost of drying the bark is more than counterbalanced by the advantages gained.

Temporary Object of the Process.—It must be remembered that this method has only been adopted to furnish a large supply of febrifuge for trial; it does not profess to make the most economical use possible of the bark. The factory is estimated to turn out during the present financial year 4800 pounds of febrifuge, which, at a rupee an ounce, will pay the whole cost of the plantations and manufacture for the year. If the product proves to be of permanent value as a remedial agent, it is probable that the process will be considerably modified to produce greater economy, but involving the use of permanent buildings and machinery.

Toxicological Studies upon Copper and its Compounds. L. M. V. Galippe. (*Journ. de Pharm. et de Chim.*, xxiii., 298.) The results of numerous experiments with dogs led the author to the conclusion that copper salts do not produce fatal effects. A dog weighing 8 kilograms received daily doses of ·5 gram of neutral acetate of copper for 124 days. During that time it was troubled with diarrhœa and vomiting, but it never lost its appetite.

It was then killed, and its liver (weighing 260 grams) found to contain ·31 gram of copper = 1·121 sulphate. The animal had in all consumed 72 grams of the acetate. 43 grams of sulphate of copper were administered to a dog in the course of 122 days; 65 grams to another within 151 days; 47 grams to a third within 107 days; and 98 grams to the fourth, a bitch, during 150 days. The liver of the last one weighed 310 grams, and contained ·223 gram of copper = ·87 gram of the sulphate. During the experiments this last dog had pupped, and the livers of the young were likewise found to contain copper. Traces of this metal were also detected in the milk. Other copper compounds, viz. the ammonio-sulphate, lactate, citrate, tartrate, malate, oxalate, oxide, subchloride, and subacetate (verdigris), yielded similar results.

The workmen engaged in the verdigris factories at Montpellier are reported not to suffer in health from their occupation. The urine of these workmen always contains copper.

Purification and Pharmaceutical Application of Petroleum. M. Masson. (*Répert. de Pharm.*, 1876, 742.) The author frees petroleum from its unpleasant odour in the following manner:—

60 grams of strong sulphuric acid and the same quantity of strong nitric acid are slowly poured into 100 kilograms of petroleum by means of a funnel having a long tube; after this, 500 grams of strong alcohol are carefully poured on the surface of the oil. The alcohol sinks down gradually, and on reaching the layer of acids causes a slight effervescence and evolution of heat. Ethereal products of a pleasant odour are thus evolved and communicated to the oil, which at the same time assumes a yellowish colour. The reaction lasts about an hour; the oil is then gently agitated with water, and the mixture allowed to settle.

Petroleum thus purified might take the place of alcohol in liniments, tincture of arnica, and other tinctures and preparations intended for external application.

The bottom layer (a mixture of acids, water, and alcohol) may be used for deodorizing the heavy oils of petroleum, by agitating them with this mixture, then allowing to settle for twelve hours, decanting, and washing with lime milk to completely remove the acid.

Chlorine as an Antidote to Prussic Acid. M. Gautier. (*Bull. Soc. Chim.*, 1876, 433.) Experiments made upon rabbits, in order to test the value of inhalations of chlorine as an antidote to prussic acid, proved very successful. Fatal doses of the poison were administered, and the gas applied a few minutes after death had apparently set in, whereby in the majority of cases the animals recovered. The same effect was observed with insects.

The Comparative Merits of Phosphide of Zinc and Phosphorus as Therapeutic Agents. (*New Remedies*, 1877, 48.) The phosphide of zinc has so far proven a most efficient agent in the successful treatment of the major part of a certain class of affections. In very many instances it has been far more curative than phosphorus. Considered in the light of a curative agent, the phosphide of zinc stands alone, not only for the certainty but for the rapidity of its action as a nervous tonic and stimulant. Its value in these respects has of late been fairly tested in the last and exhausting stages of typhoid and other fevers, where the nervous energies have been so far prostrated as to render convalescence, if not doubtful, at least tedious and protracted. The great therapeutic value of the phosphide of zinc is evinced in the most distinct manner, when used in the treatment of neuralgia. While the phosphorus is seldom curative in doses less than one-twentieth of a grain, often calling for as much as one-tenth or one-fourth, the phosphide of zinc yields as reliable and more speedy results in doses of one-tenth to one-eighth of a grain. But few stomachs can tolerate more than one-thirtieth of a grain of phosphorus before manifesting symptoms of irritation, which, in connection with the "matchy" taste soon evolved in eructations, often engenders a disgust to its further continuance. Nor are these disagreeable features altogether abolished by any of the multitudinous formulæ now in vogue. On the other hand, experience with the phosphide of zinc has proven that it enters the circulation far more rapidly than the element, and when administered in doses of from one-eighth to one-twelfth of a grain, it produces its curative influence far more readily, and is equally as permanent in therapeutic power. It has been found to be extremely serviceable in neuralgia in doses of one-eighth of a grain in the form of a pill, in angina, in loss of memory, and impotence, in loss of sleep from continued mental anxiety, and generally in those nervous affections that owe their origin to exhaustion and depression of the nerve force. Dr. Hammond's formula is one-sixteenth of a grain of phosphide of zinc, with one-fourth of a grain of extract of nux vomica, made into a pill.

The Use of Glycerin in Fluid Extracts. J. W. Lehman. (From an inaugural essay. *Amer. Journ. Pharm.*, 1877, 346.) A number of experiments were made with officinal and unofficinal fluid extracts, with the view of determining the preservative qualities of glycerin in this class of preparations. The results obtained may be tabulated as follows:—

Fluid Extract of	Menstruum.	Remarks.
Aconite root	Alcohol 3 p., glycerin 1 p.	Dark reddish brown, after two weeks muddy; filtered, became again turbid.
,, ,,	Alcohol	Of lighter colour; remained clear.
Asclepias tuberosa	Dil. alcohol 3 p., glycerin 1 p.	Gelatinized in four weeks.
,, ,,	Alcohol 2 p., water & glycerin each 1 p.	Did not gelatinize; slight precipitate.
Buchu	Alcohol 3 p., glycerin 1 p.	Dense precipitate in five days.
Conium (leaves ?)	Officinal	Dark and clear; slight precipitate in two weeks.
Digitalis	,,	,, ,, ,,
Ergot	,,	,, ,, ,,
Grindelia robusta	Dil. alcohol 3 p., glycerin 1 p.	,, ,, ,,
Hyoscyamus	Officinal	,, ,, ,,
Krameria	,,	Brown-red; clear.
Prunus Virginiana	,,	Soon turbid, and considerable precipitate.
,, ,,	Water 8 fl. oz., afterwards glycerin and dilute alcohol equal parts	Slight precipitate after four weeks.
Stramonium	Officinal	Dark and clear; slight precipitate on standing.
Valeriana	,,	Remains clear.
,,	Alcohol 3 p., glycerin 1 p.	Very muddy in two weeks; filtered, muddy again in one week.
,,	Alcohol 3 p., glycerin 1 p.	Slight precipitate in two weeks; filtered, very slight change afterwards.
Zingiber	Officinal	Remains clear.
,,	Alcohol, with small prop. of glycerin.	Precipitated some in five days.

The author concludes that the use of glycerin in fluid extracts of astringent drugs adds much to the beauty and stability of the preparation. Its use appears also to be indicated for drugs the active principles of which are soluble in water and dilute alcohol. In fluid extracts of mucilaginous drugs like pleurisy root it cannot be used to any great extent, and it is best discarded altogether in all cases where the active principle is of a resinous nature.

Salicylic Acid in Diphtheritis. Dr. Wagner. (*Zeitschr. des oesterr. Apoth. Ver.*, 1876, 441.) The author reports most favourably on the curative effects of salicylic acid in diphteritis. To children too young to use a gargle he administered ·15 to ·3 gram of the powdered acid in water or wine every two hours; older ones were treated at the same time with a gargle containing 1·5 gram of the acid and 15 grams of rectified spirit to 150 grams of water, this gargle being applied every hour. Of fifteen severe cases treated in this manner, not one terminated fatally. Recovery took place far more rapidly than the author had ever witnessed in cases treated with other remedies.

Sulphurous Acid as an Antiseptic and Antifermentative compared with Salicylic Acid. M. Baierlacher. (*Pharmaceut. Centralhalle*, 1877, 148.) The author has arrived at the following conclusions:—

1. Sulphurous acid is more powerful than salicylic acid in its antifermentative action on yeast.

2. Sulphurous acid prevents the formation or growth of mould; in this respect carbolic acid stands nearer to it than salicylic.

3. The action of emulsin and of myrosin is retarded by sulphurous acid more than by salicylic acid; but it is not entirely prevented unless the acid be used in large quantity.

4. Putrefaction is effectually retarded by sulphurous acid. The author strongly recommends the application of burning sulphur for the disinfection of rooms, and the local application of sulphurous acid in diphtheritis.

The Strength of Tinctura Opii. J. M. Maisch. (*Amer. Journ. Pharm.*, 1877, 511.) The strength of tincture of opium as ordinarily sold has been the subject of investigation by three students of the Philadelphia College of Pharmacy, class 1876–77. Mr. Jos. Stahle Smith merely determined the amount of extract left on the evaporation of one fluid ounce of the tincture, five samples giving the following results: 21·5, 15, 11·5, 9·5, and 8 grains. Each fluid ounce represents 37·5 grains of dry opium, which on an average yields 60 per cent., or 22·5 grains of extract; the presumption, therefore, is that of the five samples examined only one was made in accordance with the U.S. Pharmacopœia.

Mr. Wm. H. Llewellyn ascertained not only the amount of extract, but separated also the morphia from one fluid ounce of commercial laudanum, using for the latter operation a modification of Staples' process; his results were as follows:—

Extract from 1 fluid ounce,	15·	15·	16·	15·50	23·25	28·75	30·	32·	37·	39·50 gr.
Morphia ,, ,,	4·	3·75	3·	3·25	2·	1·75	1·	1·	·5	trace.

Opium of officinal strength should yield 3·75 grains of morphia per fluid ounce of laudanum. While some of the samples come up to this requirement, it is noteworthy that they fall short in the amount of extractive matter as usually met with in Smyrna opium; on the other hand, it is plain that at least one-half of these tinctures, which are very deficient in morphia, were artificially coloured, with the view of imparting an appearance of strength which they did not possess.

Another series of experiments with laudanum sold at retail was made by Mr. Burt P. Gates, who determined the specific gravity at 60° F. by means of a 1000-grain bottle, and made two morphiometric assays, following Staples' process with some modifications; his results are tabulated as follows:—

Specific Gravity.	·965	·952	·962	·956	·958	·955	·953	·949	·956	·943	·947	·956	·939	·950	·881
Morphia per fluid ounce.	3·85	3·70	3·54	3·39	2·96	2·62	2·77	2·46	2·16	2·08	2·00	1·85	1·63	1·39	0·77
Percentage.	10·3	9·9	9·4	9·0	7·8	7·0	7·4	6·6	5·7	5·6	5·3	4·9	4·4	3·7	2·1

Only three of these samples can be assumed to have been made from well-dried opium; five appear to have been made from imperfectly dried or from more or less moist opium; the remaining seven, of which five are also deficient in density, have apparently been made of less opium than officially directed.

A New Method for the Preparation of Extracts without Heat. A. Herrara. (*Chem. and Drugg.*, 1877, 390.) The fact that when water is partially frozen the dissolved matters remain in the mother liquor has been used commercially in a variety of ways for some years past. Impressed with the fact that even a moderate degree of heat seriously modifies the properties of most vegetable substances, the author proposes that the process just mentioned should be adopted for the preparation of extracts. The actual process is as follows:—The freshly expressed juice, or the cold water infusion, is placed in some such apparatus as that used for making ice cream, and surrounded with a mixture of crystallized chloride of calcium or chloride of sodium and pounded ice. The juice is allowed to remain till a large portion has congealed, the mass of ice is enclosed in a cloth and subjected to pressure, the press-cake is broken and again pressed, to separate the mother liquor as completely as possible. The expressed mother liquor is mixed with the bulk, and the congelation is repeated two or three times, with the precaution that it must not be carried far enough to precipitate any of the more sparingly soluble principles. The mother liquor is then put into shallow dishes and exposed to the heat of the sun or of a drying room, the temperature of which does not exceed 30° C. (86° Fahr.), until the extract has attained the desired consistence.

Extract of conium, prepared with unpurified juice by the process mentioned, has preserved the characteristic odour of conia, and by dissolving it in water the author obtained a solution exactly representing the juice of the plant in appearance and properties, and giving, when heated, an abundant coagulation, proving that even albumen had remained unaltered. 1,750 grams of cow's milk, of 9° B., left, after three congelations, 750 grams of a liquid having a density of 14°, and by evaporation in the sun this left a dry extract of milk, which again formed that liquid on being dissolved in water. Extract of rhatany, prepared by the process of congelation, dissolves completely in water, with a red colour, and has a much more astringent taste, compared with an extract which was prepared with the utmost precaution by evaporation in a water bath. Similar comparisons were made with the extracts of catechu, aloes, and others, and in all cases a very notable difference was observed, which is explained by the final evaporation in the proposed process being conducted by the heat of the sun or of the drying closet, which is insufficient to effect a change or to volatilise the volatile principles in any appreciable degree.

It may be objected that the vegetable juices should be previously purified; but it should be remembered that coagulated albumen always encloses a considerable portion of the active principles, and that the heat necessary to effect the coagulation and the evaporation by means of a water bath is sufficient to change many principles; also, that the extracts thus prepared are sometimes inert or less active. The careful experiments made by Orfila and the clinical experience of others demonstrate that extracts prepared with unpurified juice are the stronger.

For the extracts prepared from juices by the method indicated, the author proposes the designation of *opopycnols*, derived from the two Greek words meaning *juice* and *to condense*.

Iodide of Starch as an Antidote to Poisons. Dr. Bellini. (*Répert. de Pharm.*, 1877, 17; *Journ. de Med. de Bruxelles*, 1877, 174.) In a paper read before the Medical Society of Florence, the author recommends iodide of starch as a valuable antidote in cases of poisoning by caustic alkalies, alkaline, or earthy sulphides, and vegetable alkaloids. The preparation is easily administered in large doses, does not possess the irritating properties of free iodine, and readily forms harmless compounds with the substances named. To avoid the subsequent decomposition of the latter, its administration may be followed by an emetic. As an antidote to alkaline and earthy sulphides, the author thinks it preferable to all others. In cases of poisoning by ammonia, caustic potash, or soda, it is applicable when acid drinks are not at hand.

The Decolorization of Iodide of Starch. A. Vogl. (*Neues Repert. f. Pharm.*, 1876, 565.) The disappearance of the blue colour of iodide of starch at a temperature of 70° to 90° C., is partially due to the volatilization of iodine. A piece of starch paper held over the flask in which the liquid is heated, turns blue. On boiling the liquid for some time, the evolution of iodine vapour ceases, and when this point is reached, the blue colour is no longer restored on cooling.

The statement occurring in many books that iodine may thus be completely expelled from its combination with starch, is not confirmed by the author's experiments. Even after prolonged boiling, and long after the solution has ceased to resume its blue colour upon cooling, it is immediately turned blue on the addition of nitric acid, chlorine, etc. In the same manner the presence of iodine can be shown in the horny translucent residue left on evaporation of the solution. The author thinks that the iodine exists in this residue in the form of a very stable and probably definite combination calling for further investigation.

Under the influence of sunlight a solution of iodide of starch also loses its colour, which is restored by nitric acid.

The Preservation of Pulvis Ergotæ. (*Chem. and Drugg.*, from *Journ. Therapeutique.*) Divers plans have been proposed for the preservation of powdered ergot, which should retain its physiological properties unimpaired. Appert proposed the employment of balsam of tolu. M. Bories recommends that a little mercury should be kept at the bottom of the vessel containing it. Others have recommended that alcohol should be used in the same way. All these processes necessitate that the powder should be prepared when required, as it is much more alterable than the fungus itself. . . .

Towards the end of 1874 the authors powdered 100 grams of carefully selected ergot. 50 grams were placed in a dry bottle; the other 50 grams were mixed with 5 per cent. of powdered benzoin, and set aside in a similar bottle. Both bottles were placed in the laboratory, with their mouths simply covered with a card. Fourteen months afterwards the benzoinated powder was unchanged, while the other was an odoriferous mass of living matter. The powder thus preserved was found thoroughly reliable by several eminent obstetricians.

The Purity of Chloral Hydrate. C. Annessens. (*Journal de Pharm. d'Anvers*, 1877, 1.) The formation of white fumes on approaching chloral hydrate with a glass rod moistened with solution of ammonia has been frequently regarded as an indication of the presence of hydrochloric acid, and consequently as a proof of the unfitness of the preparation for medicinal use. The author shows these conclusions to be erroneous. Perfectly pure chloral hydrate at any but very low temperatures always fumes when brought near ammonia, and the presence of hydrochloric acid can only be demonstrated by means of silver nitrate. The white cloud which is formed from the fumes of ammonia, and the volatilized vapour of chloral hydrate, is due to the formation of ammonium formiate. This may easily be proved by absorbing the vapour of chloral with a piece of blotting-paper saturated with ammonia; an abundant white cloud is produced. The paper is washed with distilled water, the excess of ammonia is evaporated, solution of silver nitrate is added, and the whole heated. The mixture immediately becomes cloudy, then blackens, and deposits upon the sides and bottom of the vessel a fine mirror of metallic silver.

If hydrochloric acid be really present in a sample of chloral, it is most easily detected by testing the aqueous solution with silver nitrate, which will at once produce a precipitate or turbidity.

Chloral hydrate may be considered pure if it stands the following tests:—

1. It should be neutral to test paper.
2. With nitric acid it should not give off any red vapours.
3. Its solution ought to remain clear on the addition of silver nitrate.
4. When decomposed by caustic potash it should yield 72·2 per cent. of chloroform.

The Qualitative Examination of Cinchona and Opium. MM. Lepage and Patrouillard. (*Pharm. Journ.*, 3rd series, vii., 795.)

Cinchona.—Take a fragment from several barks in the same bundle and reduce to a fine powder; suspend 1 gram of the powder in 10 grams of distilled water containing 1 gram of dilute sulphuric acid, and leave them in contact two or three hours, agitating frequently. At the end of this time add 70 grams of distilled water, and leave in contact several hours more, still taking care to agitate the mixture frequently. Then allow it to deposit, and afterwards filter. If the cinchona be of good quality, solution of the double iodide of cadmium and potassium, prepared by dissolving 2·80 grams of iodide of cadmium and 2·50 grams of iodide of potassium in 50 grams of distilled water, when poured in slight excess into this liquid, should produce at once an abundant turbidity, resulting after some hours in a voluminous precipitate. If the bark contain no more than 10 or 12 parts of alkaloid per 1000 the reagent does not give rise to any turbidity, or at most to a slight opacity. The yellow, red, and grey barks may be examined in this manner.

Opium.—Reduce 0·10 gram to powder in a glass mortar, and suspend the powder in 25 grams of distilled water; leave the mixture in contact during half an hour, agitating occasionally, and then filter. Take two-thirds of this liquor, which should possess a markedly bitter taste, and pour into it some drops of solution of iodide of cadmium and potassium. If the opium be of good quality an abundant turbidity is produced, to which rapidly succeeds a flocculent precipitate; whilst if it contain not more than 4 or 5 per cent. of alkaloid or less, at the most a slight turbidity will be produced. The one-third part of the solution that is reserved, when tested with very dilute perchloride of iron ought to acquire a decided red colour, which is the reaction characteristic of meconic acid.

The Officinal Wine of Quinine. (*Chem. and Drugg.*, 1877, 154.) Every one who has prepared the wine according to the Pharmacopœia formula must have noticed immediately after effecting solution of the quinine the formation of a brown flocculent precipitate, varying probably with different orange wines somewhat in quantity, but always considerable and always of the same appearance. The precipitate is annoying, especially to makers of large quantities of the wine, as it both necessitates filtration and renders the process tedious. Moreover, a second deposit after a time almost invariably again forms, which, although smaller in quantity, is even more troublesome if it appears, as very probably it may, after the preparation has been bottled and stored.

To determine the nature, cause, and extent of this precipitate, a series of investigations were undertaken, the result of which may be briefly summarised as follows:—

1. The precipitate was found to be principally tannate of quinine, along with extractive and colouring matters.

2. The quinine recovered from the deposit varied in quantity, but was frequently found to form a large percentage of the quinine originally added to the wine.

3. The deposit continued to form so long as any tannin was found to exist in the wine, after which the addition to any extent of more quinine and citric acid gave no further precipitate.

The raisins from which the wine is generally fermented were at first suspected as being the primary cause of the presence of the tannin; but from further inquiries it was ascertained that tannin is very generally employed to clarify the wine in certain stages of the process of fermentation, and that the excess of tannin thus added is afterwards removed from the wine by the addition of isinglass.

This process, even where carefully conducted, seems at the best to partake a good deal of the rule of thumb procedure, the principal care apparently being not to add too much of the isinglass, excess of which in the wine is in some respects even more objectionable than the tannin. Of many plans which have been tried to rid the wine of the superfluous tannin, none have been altogether successful which have not in some way or another been objectionable. Even when honestly prepared, which we are sorry to say it very seldom is, it is apparent that the quinine which it contains must ultimately be an unknown factor, whilst it has this further serious objection, that in too many instances it contains also an unknown quantity of alcohol. The Pharmacopœia states that it contains about 12 per cent.; but this will be found insufficient to keep it from decomposition, and as a matter of fact most commercial orange wines contain double this percentage of alcohol, and in some instances more, thus exceeding in strength even a fortified sherry.

Poisonous Properties of Glycerin. MM. Dujardin Beaumetz and Audigé. (From *Bull. général de Thérap.*) The authors have studied the effects on dogs of large doses of glycerin hypodermically injected, and have arrived at the following conclusions:—

1. Pure glycerin injected in the proportion of 8 to 10 grams for each kilogram of the weight of the animal produces death within twenty-four hours.

2. The symptoms produced are analogous to those of acute alcoholism.

3. The microscopic lesions are similar to those in alcoholism.

4. From a therapeutic point of view it should therefore be under-

stood that the administration of large doses of glycerin may be attended with danger.

The Alterability of Calomel under various Influences, and the Precautions necessary in its Therapeutic Employment. M. Jolly. (*Chem. and Drugg.*, from *Gazette Medicale.*) Owing to the report which appeared in the Italian pharmaceutical papers, on the formation of corrosive sublimate in a mixture of calomel and sugar, the president of the Society of Practical Medicine engaged the author to make some experiments to clear up all doubt on this subject.

Calomel has a decided tendency to decompose into mercury and corrosive sublimate, and many physical and chemical agents facilitate this decomposition. The author has investigated the action of these various agents, and embodies his results in the following summary.

Heat always causes decomposition to a greater or less extent. Perfectly pure and dry calomel, sublimed alone, takes a greyish tinge from the liberation of metallic mercury.

Light causes the change into mercury and corrosive sublimate to take place rapidly, as evidenced by the change in colour.

One gram of calomel digested with 100 c.c. of a 2 per mille solution of hydrochloric acid for six hours, at a temperature of 104° Fahr., yielded 3 milligrams of corrosive sublimate.

The same quantity digested with 5 per mille solution of sodium chloride, yielded at the end of six hours 1 milligram of sublimate.

A 2 per cent. solution of citric acid (to represent fruit preserves, in which calomel is often administered) caused the production of 1 milligram of sublimate.

The hydrochloric acid and sodium chloride represent the gastric juice. When calomel passes into the intestines, it comes in contact with the alkaline secretions of the bowels.

A half per cent. solution of sodic hydrate, after digestion for six hours at 104° Fahr. with one gram of calomel, gave rise to 6 milligrams of corrosive sublimate.

Under similar circumstance a 1 per cent. solution of sodic carbonate gave rise to 4 milligrams, and a 1 per cent. solution of calcined magnesia to 3 milligrams, of mercuric chloride. 1 gram each calcined magnesia and calomel were mixed, and at the end of twenty-four hours were treated with distilled water; 1 milligram of sublimate was found. Lime acts like magnesia. Neither carbonate of lime nor magnesia had the least effect at the end of six hours.

From these experiments the author draws the conclusion that calomel when used therapeutically must not be mixed with inferior sugars, which are always acid or alkaline, nor with the alkaline chlorides and earths, solutions containing alkaline hydrates or carbonates, or mineral or vegetable acids.

The Action of certain Manipulations and Reagents on Calomel. F. M. Corwin. (From a thesis presented to the New York College of Pharmacy: *New Remedies*, 1877, 211.) The mercurous chloride, or calomel, is mild in its action on the human system, being a safe and much-used remedy.

The mercuric chloride, and mercuric salts in general, are powerful and corrosive agents, often producing serious and fatal results.

The object of the following experiments was to ascertain whether *mercuric* salts were produced from *mercurous* (namely *calomel*) by the agents and methods described.

The agents were either physical or chemical.

The physical agents were trituration, boiling with water, and sublimation.

The chemical agents were certain dilute acids and salts of the U. S. P.

The tests used for the detection and identification of mercuric mercury were metallic copper and hydrosulphuric acid in strongly acidified solutions.

In all cases where a deposit was obtained on copper, the copper, after being thoroughly washed and dried, was placed in a clean dry test-tube and heated to redness.

If mercury was present it sublimed and collected in a cooler part of the tube. A crystal of iodine was then placed in contact with it, and heat again applied, when the yellow iodine of mercury turning red by friction sublimed in another part of the tube.

The hydrosulphuric acid was added in small portions at a time, producing at first a light coloured precipitate, turning yellow, orange, brown, and black as the successive portions were added. This reaction is characteristic of a mercuric salt.

Several attempts to obtain absolutely pure calomel proved unsuccessful. That used, being the purest which was examined, was found to contain a small quantity of ferric iron, probably as ferric chloride.

1. Physical Agents.—a. *Trituration.*—About two drams of calomel were rubbed in a dry porcelain mortar. On moving the pestle through it with pressure it produced shining *straw yellow* streaks, and the whole powder gradually assumed a yellowish tint. After rubbing for half an hour it was macerated with water, filtered, and the filtrate acidified with hydrochloric acid.

Copper: no action. Hydrosulphuric acid: no action.

b. *Boiling.*—1. About two drams were heated in a flask with water, on a water bath, for fifteen minutes, the mixture filtered, the filtrate evaporated about one-half on a water bath, and acidified with hydrochloric acid.

Copper: no action. Hydrosulphuric acid: no action.

2. About two drams were boiled in a flask with water by direct contact with flame, and under constant agitation, for fifteen minutes; filtered, the filtrate evaporated about one-half on a water bath, and acidified with hydrochloric acid.

Copper: *a deposit.* Hydrosulphuric acid: *characteristic precipitate.*

c. *Sublimation.*—1. About twenty grains were heated in a dry test-tube, the heat being only sufficient to slowly sublime it. It was then macerated with a small quantity of water, filtered, the filtrate acidified with hydrochloric acid.

Copper: no action. Hydrosulphuric acid: no action.

The sublimate was perfectly white.

2. About twenty grains were heated so as to sublime rapidly, the glass becoming red hot. It was macerated with water, filtered, and the filtrate acidified with hydrochloric acid.

Copper: *a deposit.* Hydrosulphuric acid: *characteristic precipitate.*

The sublimate had a greyish appearance in places, probably due to metallic mercury.

II. CHEMICAL AGENTS.—a. *Acids.*—The acids used were the dilute acids of the U.S. Pharmacopœia. About a dram of calomel was placed in a five-inch test tube, the tube was nearly filled with an acid, and allowed to macerate for three days, being agitated occasionally. It was then filtered and the filtrate evaporated about one-half on a water bath.

With some acids a change was noted in the appearance of the calomel; with others it remained unaltered. The following table exhibits the results:—

Acids.	Copper.	Hydrosulphuric Acid.	Appearance.
Hydrochloric . . .	Deposit	Characteristic ppt.	Unchanged.
Nitric	Not used	,, ,,	,,
Sulphuric . . .	No action	No action	,,
Hydrocyanic . .	Deposit	Characteristic ppt.	Turns dark.*
Nitro-hydrochloric	Not used	,, ,,	Unchanged.
Phosphoric . . .	No action	No action	,,

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* On the reaction between calomel and hydrocyanic acid, see a paper by T. H. Powell and J. Bayne, in *Year-Book of Pharmacy*, 1876, 372.

b. *Salts.*—Of the salts used, sixteen were in solution with water. The solutions were made by dissolving 1 part of the salt in 10 parts of water, with one exception, namely, the potassic chlorate solution, which was made by dissolving 1 part of the salt in 20 parts of water.

About half a dram of calomel was placed in a five-inch test tube, the tube nearly filled with a solution and allowed to macerate three days with occasional agitation. It was then filtered, and the filtrate acidified with hydrochloric, nitric, or sulphuric acid, according to the character of the salt.

With some of the solutions a change was noted in the appearance of the calomel, either immediately or on standing.

Solution of	Copper.	Hydrosulph. Acid.	Appearance.
Potass. Bromide . .	Deposit	Characteristic ppt.	Lead colour.
,, Chlorate . .	No action	No action	Unchanged.
,, Cyanide . .	Deposit	Characteristic ppt.	Dark, nearly black.
,, Hypophosphite	No action	No action	Unchanged.
,, Nitrate . . .	,,	,,	,,
,, Sulphate . .	,,	,,	,,
,, Sulphite . .	,,	No ppt. Separation of S.	Greenish grey.
Pot. and Sod. Tartrate	Deposit	Characteristic ppt.	Unchanged.
Ammon. Bromide. .	,,	,, ,,	Slate colour.
,, Chloride . .	,,	,, ,,	Unchanged.
,, Iodide . .	,,	Orange red ppt., which gradually turns dark, same as $HgCl_2$ in NH_4I	Turns yellow, then dark with green tint. Solution is yellow.
,, Nitrate	,,	Characteristic ppt.	Dark at point of contact. Grey on agitating.
,, Sulphate. .	,,	,, ,,	Unchanged.
Sodic Chloride . . .	,,	,, ,,	,,
Ferric ,,	No action	No action	,,
,, Pyrophosphate .	,,	,,	,,

Of the two following salts, about a dram of each was rubbed, with an equal bulk of calomel, in a porcelain mortar for fifteen minutes. They were then macerated with a small quantity of water, filtered, and the filtrates acidified.

Filtrate from	Copper.	Hydrosulphuric Acid.
Bismuth Subnitrate .	No action	Peculiar ppt. Not characteristic of mercury.
Ferric Ferrocyanide .	,,	No action.

Note on a Test for Alcohol.—Dr. H. Hager. (*Pharm. Centralhalle*, 1877, 154.) A solution of 1 part of molybdic acid in 10 parts of strong sulphuric acid has been recommended as a test for ethyl alcohol and other alcohols. In a more concentrated form the same reagent has been in use for some time as a test for morphine (Fröhde's test), and has since its introduction for this purpose been applied to a good many other substances possessing the properties of reducing agents. For its application as a test for alcohol, Davy recommends the following precautions:—Three to four drops of the reagent should be gently heated in a porcelain capsule, and one or two drops of the liquid to be tested then added; if the latter is likely to contain but a very small proportion of alcohol, the mixture should be warmed in a water bath.

Following these directions the author has repeatedly tried the test, but has failed to obtain the reaction.

Practical Hints about Dialysis.—(*New Remedies*, 1877, 229.) Dialysis is a species of osmosis, that is, a diffusion or passage of fluids through organic membranes. The late Thomas Graham, to whom we are indebted for the first knowledge of the law of diffusion, divides bodies, in respect to their diffusibility, into two classes: one of these he termed *crystalloids*, being mostly crystallizable substances, or closely approaching them in character. They have a strong affinity for their solvents, and retard the evaporation of the latter by their presence. The other class he denominated *colloids*, which are uncrystallizable, of a glassy or horny structure when dry (like gelatine, etc.), and generally of an insipid taste.

These two classes of bodies may be almost entirely separated from each other by placing the mixture containing them on one side of an organic membrane which is in contact with water on the other. A double osmosis then takes place; from one side the crystalloids pass through the membranes into the water, and from the other side water passes into the mixture. The ratio of diffusion is inversely proportional to the densities of the liquids on either side: a dense liquid will pass slowly; a dilute liquid, or pure water, more rapidly. The colloid substances, however, are not absolutely retained on one side; they also pass through the membrane, but at so slow a rate that the crystalloids may nearly all have penetrated the membrane before an appreciable amount of colloids has accompanied them.

The apparatus employed for this process is generally constructed in the following manner:—A light hoop of wood, or of gutta percha, or better, of glass, about 2 inches deep and 5–10 inches in diameter, is covered with a piece of moistened bladder or parchment-paper—which have been found in practice to be the most suitable membranes for this purpose—so as to form a sieve-like vessel. The disk of bladder or parchment-paper should be considerably larger in diameter than the hoop, and it should be bound to the latter by a string, or by another hoop of similar material. The membrane must be entirely free from rents or pin-holes, which may be ascertained by sponging one side with water, and observing whether any wet spots appear on the other side. In the latter case, the defects may sometimes be remedied by applying liquid albumen, and coagulating it by heat. Broad glass shades, or lamp-chimneys, or similar articles, may also be used. In absence of these, a funnel, the neck of which is broken off, may answer; only in this case the membrane is placed inside of it, folded in the form of a star-filter. The apparatus then, prepared in any of these ways, is called the *dialyser*.

This is floated upon a quantity of pure water contained in another larger vessel, which has received the name *exarysator*. The size of the latter and the amount of water contained in it depend upon the object to be accomplished. If the colloid substance remaining in the dialyser be our chief object, it is best to employ a large quantity of water at once; the crystalloid bodies pass into this in the form of a dense solution, which sinks to the bottom and causes the lighter unsaturated water to be constantly pushed up towards the membrane. If we, however, want to separate the crystalloids, to the neglect of the colloids, we must use as small a quantity of water as possible.

The liquid to be dialysed is poured into the dialyser to the height of about one-half inch, or a little more, but never to exceed one-fourth of its depth, and the apparatus then floated on the water in the exarysator. The best way is to introduce just as much liquid into the dialyser as will cause the latter to sink into the water to one-third of the height of the contained liquid. These precautions are necessitated by the fact that water will diffuse upwards into the dialyser more rapidly than the crystalloids will pass through the other way; and this is more particularly the case when bladder is used. The solution of crystalloids produced in the surrounding water is called *diffusate*. In most cases the diffusion may be greatly accelerated by the application of a gentle heat.

NOTES AND FORMULÆ.

PART IV.

NOTES AND FORMULÆ.

A New Process for the Estimation of Chicory in Coffee. A. Smith. (*Chemical News*, 34, 1876, 283.) Take 5 grams of the coffee, and pour upon it about 25 c.c. of boiling water, and filter; then pour it into a Nessler tube, and add acetate of lead, which will throw down the colouring matter of the coffee, but leave that of the chicory, which can then be estimated by comparing it with a standard of a known quantity of chicory.

The Presence in Beer of a Substance Resembling Colchicine. H. van Geldern. (*Archiv der Pharm.*, July, 1876.) E. Danneberg stated recently that he had obtained from beer an alkaloid resembling colchicine in its reactions (*Archiv der Pharm.*, May, 1876.) The writer has obtained the same body, in 1874, by the method of Stas and Otto, and found then that it could also be obtained from a mixture of unadulterated hops and gelatin. The latter body is always present in beer, and is possibly the cause of the precipitate formed with the general reagents for alkaloids, and which are not produced if pure hops alone be employed for the experiment.

A Spurious Beeswax. (*New Remedies*, from *Pharm. Post.*) In appearance, colour, fracture, brittleness, pliability, and odour (on the outside portions), this pseudo-wax could scarcely be distinguished from the genuine. But the freshly-cut surfaces had a lustre different from that of true wax, and on breaking the mass into pieces a distinct odour of resin was perceptible. On melting it with a gentle heat, the honey odour disappeared entirely, but the pitchy odour became gradually more intense and oppressive. These simple means having already pointed out the probable composition, the melting point and the specific gravity were determined in the following manner:—A wide-necked glass flask was filled three-fourths with water, and into the middle of this was immersed a thermometer and a test-tube containing some fragments of the wax; the mouth having been loosely stoppered, heat was carefully applied, until about one-third of the wax had melted. The temperature at this point was 70° C. (158° F.). To determine the specific gravity, two equally large pieces were dropped into a beaker containing dilute alcohol, in which they sank; distilled water was now gradually added until, after stirring, the pieces floated a little below the level of the liquid. The specific gravity of the latter, being found to be 0·962, corresponds to that of the wax. One gram of the substance was warmed in a small flask with 10 grams of chloroform. The solution was clear and yellow, but in cooling became opaque, and deposited on the sides an almost transparent and colourless mass. Another gram was dissolved by heat in 15 grams of 70 per cent. alcohol, and set aside to cool. This caused the deposition of globular colourless masses, leaving the liquid of a clear yellow colour. The globules having been separated by filtration, they were dried and weighed. They amounted to 0·6 gram, and had a specific gravity of 0·910. The filtrate, on evaporation, left behind a brittle, yellow resin, weighing nearly 0·4 gram. One gram of shavings was next boiled in a solution of 1·4 gram of borax in 20 grams of distilled water, whereby a colourless mass was obtained. floating on the top of the liquid, which latter was cloudy, but did not become either milky or gelatinous on cooling. Japan wax was therefore not present. Another portion, in fine shavings, was shaken with dilute ammonia; but the liquid remained clear and transparent, and the substance unaltered, which proved the absence of stearine as well as tumeric and orleans. The above-mentioned globular masses, free from resin, were now examined for paraffin. They had a lustrous, alabaster-like appearance, became soft on kneading, without getting adhesive, and dissolved easily and completely in oil of turpentine and benzin, but were entirely insoluble in five parts of hot absolute alcohol. They were hence pure paraffin. The composition of the substance was therefore 60 parts of paraffin, and 40 parts of yellow resin, covered with a thin coating of genuine beeswax. The specific gravity in this case was identical with that of many samples of genuine beeswax.

Koumiss Extract. (*Zeitschrift des oesterr. Apoth. Ver.*, 1876, 526.) The following formula yields a good preparation:—

Powdered Sugar of Milk	100 parts.
Glucose (prepared from starch) . .	100 ,,
Cane Sugar	300 ,,
Bicarbonate of Potassium	36 ,,
Common Salt	33 ,,

Dissolve these ingredients in 600 parts of boiling fresh whey of milk, allow the solution to cool, then add 100 parts of rectified spirit, and afterwards 100 parts of strained fresh beer yeast. Stir the mixture well, and put it into bottles containing a quarter of a litre each, The bottles must be well corked and kept in a cool place.

For the preparation of koumiss add 5 to 6 tablespoonfuls of this extract to a litre of skimmed, lukewarm milk contained in a bottle of thick glass; cork well, keep the bottle for half a day in a moderately warm room (at 16°–20° C.), and afterwards in a cool cellar, shaking occasionally. The bottle should be filled to within 3–4 centimetres of the cork. After two days the koumiss is ready for use.

Poisonous Materials in Hair Dyes. (The *Lancet*, January 13th, 1877.) Out of twenty-one examples of so-called hair restorers, including all the best known, examined, no less than fourteen were practically identical in their nature. They contained sulphur in suspension, and also lead in varying, but always in very considerable, quantity. Three of these preparations bore American labels, the rest were English. The descriptions varied a good deal. Only one was plainly described on the label as poisonous if taken internally, while many were described as "perfectly harmless," "free from injurious substances," and so on. The prices varied from 1*s.* to 6*s.* per bottle.

Two more samples, one of them American, were found to contain lead and sulphur, but in a different form. The sulphur was present as hyposulphide; and in fact, these preparations may be substantially imitated by adding hyposulphide of soda to a solution of a lead salt. A white precipitate first appears, which dissolves in excess, and the solution so obtained *does not give a precipitate with iodide of potassium.* This is noteworthy, because in the handbill which accompanies one of the samples purchasers are warned against the dangerous hair preparations which contain lead, as likely to lead to paralysis of the brain and insanity, and are directed to test all preparations with *iodide of potassium.*

In another sample, an American one, no free or loosely combined sulphur was found, but only lead in considerable quantity. Another of the preparations was contained in two bottles, in one of which ammonio-nitrate of silver, and in the other pyrogallic acid was detected. This, therefore, belongs to an entirely different class from the preceding.

The remaining three preparations analysed were intended for lightening, instead of darkening, the colour of the hair. No substantial difference between these samples was detected. Each was found to contain a tolerably concentrated and slightly acidulated solution of peroxide of hydrogen. It is well known that this is the active agent in preparations of this kind. It can hardly be considered as poisonous, but its action on the hair is said to be injurious. The silly fashion which prompted its use is, the authors believe, dying out.

It will be seen that, out of the twenty-one samples examined, no less than seventeen contained lead. This lead was present, it must be remembered, not as a mere trace, but in most cases in large and deleterious quantity. In one sample, and that not the worst, was found five grains and a half of lead (equivalent to about 10 grains of crystallized sugar of lead) in each fluid ounce of the liquid.

A subsidiary question arises out of this inquiry which deserves the most careful consideration of the medical profession. Is it not possible that lead poisoning may sometimes be produced by the incautious use of these preparations? Evidence upon the point is conflicting, and many physiologists hold that such an absorption through the scalp cannot take place unless the skin is broken. Taylor quotes a case to the contrary which came within his own observation, and many others of the same kind have been noticed. But few, if any, of these cases are definitive, and real proof appears still to be lacking. It is, perhaps, not likely that such poisoning commonly occurs, if it ever does. In the majority of instances the liquid would probably be used with a certain amount of discretion, and would be applied mainly to the hair rather than to the head. But if the preparation were used incautiously, if the lead solution were rubbed frequently and in considerable quantity into the skin of the head, there would be danger, especially if the skin were broken.

Many recorded cases show that very minute quantities of lead may after a time produce symptoms of poisoning. Certain circumstances, moreover, induce the authors to think that incipient lead poisoning is more common than is generally supposed. In all chemical laboratories the testing for lead in drinking water is a common experience. The number of samples of water sent for this purpose is surprising. Now, in a great many instances no lead is found; and it is worthy of consideration, whether in some of these cases the symptoms which threw suspicion unjustly on the water may not have been caused by the use of lead cosmetics.

Regeneration of Spent Albumen by Means of Pepsin. J. Wagner and G. Witz. (*Journ. Chem. Soc.*, Aug., 1876, from *Dingl. polyt. Journ.*, ccxix., 166.) The property of an aqueous solution of albumen to deposit the albumen in the insoluble form on application of heat, is applied to the fixing of a variety of important colours upon cotton. Both soluble and insoluble colours are mixed with the cold solution, printed on the cotton piece, and the latter is then steamed, which converts the soluble albumen into the insoluble variety, forming a kind of fixed and elastic varnish upon the cloth, and mechanically fixing the colouring matter. Both egg and blood albumen pass into the insoluble form, *either wholly or partially*, if the temperature of the drying chamber has passed 35°, or even if exposed to the sun accidentally, or after allowing it to stand too long. Now, the problem has been, how to recover albumen which has thus become insoluble and is lost, so as to obtain it again in the soluble form for further service? Dilute alkaline carbonates or hydrates could bring such albumen into solution again, but such a solution lacks the power of coagulating on application of heat; in fact, the constitution of the albumen is altered by the alkalies, a portion of its sulphur being abstracted, and the substance in solution is therefore not albumen at all.

This prejudicial action of alkalies is at times experienced in working; thus, if the basic lead chromate be not completely freed by washing from adhering lime, and be then thickened with albumen and printed, the bright orange is not obtained on the cotton on steaming, but through presence of lead sulphide, a muddy brown.

At length J. Wagner devised the following successful method:—He brought 350 to 400 grams of such unserviceable albumen into contact with 30 grams of calf's stomach, cut into little pieces and distributed through 1 litre of water. The water was treated with 10 grams of concentrated hydrochloric acid, and had a temperature of 37·5°. After 24 to 36 hours' standing the whole was passed through a fine sieve, and the filtrate neutralized with ammonia, and thus an albumen solution was obtained which answered every purpose completely. Witz uses a sheep's stomach, and to 1 litre of acidified water nearly 125 grams of dry insoluble albumen. He states that pig's stomachs are even more active than sheep's. He further digests for 40 hours at a temperature of 35° to 40°, whereby somewhat more than half the albumen goes into solution. The dissolved portion being separated by a sieve, the insoluble portion is treated once more with acidified water in the same manner, to bring a further portion of albumen into solution. The solution so obtained is without odour and but little coloured, a fact worthy of note as regards blood albumen. It has also the property, after neutralization by ammonia, to become coagulated either by boiling or by addition of alcohol. Experiments as to the use of this albumen in ultramarine printing, showed that on steaming a pure fast blue is obtainable, unaffected by boiling soap solution. There is one reaction which marks a difference between albumen recovered by pepsin and ordinary albumen. The former treated with acetic acid, before or after neutralization with ammonia, either does not at all become turbid, or only slightly, and in no case gelatinizes, even after long standing. On the contrary, one part of egg albumen dissolved in 10 parts of water, so that the filtered solution has a sp. gr. of 1·027, and treated with an equal or half volume of acetic acid of sp. gr. 1·050, immediately forms a solid transparent jelly. This also takes place if hydrochloric acid be added. Witz has proved conclusively that under no circumstances whatever is coagulated albumen soluble in acetic acid. The text-books usually state that albumen solutions are not precipitated at all by acetic acid; and are thus in great error. Digestion with pepsin is thus a certain method of bringing coagulated albumen again into solution. Just as cloth, which has undergone some injury in finishing, may be quite freed from its size by digestion with malt, and much more easily than by long treatment with boiling water, so by the help of pepsin printed albumen colours, even after steaming, can be completely removed from the fabric.

For this purpose the piece is placed in warm, slightly acidified water, together with some pieces of the membrane of a calf's stomach. The pepsin in presence of the dilute acid dissolves the albumen, and the colouring matters, as chrome green, lampblack, chrome yellow, ultramarine, ochre, etc., are now readily removed by washing. Pepsin can bring about the solution of albumen coagulated by boiling, as well as that of otherwise insoluble albumen; but the two solutions differ, as the former will not coagulate on boiling, but the latter will. The presence of a small quantity of free hydrochloric acid is indispensable in aiding the solution of the albumen by the pepsin. Dilute hydrochloric acid (1 part of sp. gr. 1·169 in 100 of water) alone, after some days, at a temperature of 38°, can effect the solution of insoluble albumen. The solution will coagulate on boiling, and answers well in printing. By digesting blood-fibrin in dilute hydrochloric acid, a fibrin solution is obtained, which coagulates on boiling, exactly as the albumen solution above-mentioned does. It is thus possible that fibrin would make a good substitute for egg albumen. Coagulated fibrin, like albumen, on treatment with acidified pepsin solution, dissolves, but apparently in an altered or modified form, as the solution will not coagulate on boiling. Coagulated fibrin can also be dissolved gradually by dilute hydrochloric acid (1 part of sp. gr. 1·169 to 100 of water). On heating the solution precipitates the fibrin as a thick, solid jelly.

Mistura Salicylica Effervescens. (*Pharmaceut. Centralhalle*, 1877 75.)

℞	Acidi Salicylici	8,0 grams.
	Syrupi Aurantii corticis	30,0 ,,
	Aquæ destillatæ	207,0 ,,

In lagenam immissis adde

Sodæ bicarbonatis	5,0 ,,

lagenam statim obturando. Sepone loco frigido, donec solutio effecta fuerit.

Sign. ℥ss vel ℥i singulis vel secundis horis.

Boli Tænifugi. (*Pharmaceut. Centralhalle*, 1877, 76.)

℞	Florum Kosso	30,0 grams.
	Kamalæ	15,0 ,,
	Extracti Filicis maris ætherei	4,0 ,,
	Mellis depurati	q. s. ,,

Misce. Fiant boli sexaginta.

Coumarin and its Uses. L. von. Cotzhausen. (*Amer. Journ. Pharm.*, Sept., 1876, 405.) In preparing coumarin from tonka beans, they were grated and exhausted by ether; on evaporating the solvent, crystals of coumarin, rendered impure by fatty matter, were obtained and purified by repeated crystallization from alcohol. Sixteen troy ounces of tonka yielded 117 grains of coumarin. This is the process of Boullay and Boutron-Charlard. A somewhat smaller amount was obtained by substituting petroleum benzin for the ether, and this solvent is recommended as being more economical. Coumarin was obtained in a similar manner also from the dried herbs of *Asperula odorata*, Lin., *Melilotus officinalis*, Pers., *Liatris odoratissima*, Willd , and *Galium triflorum*, Mich.

The last-named herb is frequently collected in this country under the supposition that it is the *Waldmeister* (*Asperula odorata*) of Germany, which is prepared by macerating the herb in a cheap quality of Rhine wine, and adding sugar and a few drops of orange or lemon juice to suit the taste; cider may be used in place of wine. Galium, like asperula, belongs to the order *Rubiaceæ*, and on drying acquires a fragrant odour, due to coumarin, and contains also an astringent principle, a yellow resin, a fatty, rather unpleasant oil, and grape sugar.

Coumarin is proposed by the author as an ingredient in the following preparations, taking the place of tonka beans and some of the herbs mentioned above :—

Extr. New Mown Hay.—Coumarin, gr. xij.; essence of rose, ʒss.; cologne spirit, ℥ij.

Extr. Mille Fleurs.—Coumarin, gr. x.; oil of cinnamon, gtt. ij.; oil of rose, gtt. iij.; oil of neroli, gtt. v.; oil of lemon, gtt. xv.; tincture of musk, gr. xv.; tinct. benzoin, gtt. xx.; cologne spirit, ℥iij.

Extr. Tonquin Musk.—Musk, gr. x.; cologne spirit, ℥iij. Digest, filter, and add oil of neroli, gtt. j.; coumarin, gr. xij.; extract of vanilla, ʒij.

Fluid Extract of Tonka.—Digest tonka, ℥viij., with strong alcohol, reserve the first six fluid ounces, evaporate the remainder to two fluid ounces, and mix.

Sachet Mille Fleurs.—Tonka, ℥j.; vanilla, ʒiij.; cinnamon and cloves, each ʒiv.; rose leaves, ℥ij.; orris root, ℥v.; oils of mirbane, lavender, and rose-geranium, each gtt. x. Comminute by grating, cutting, or bruising, and mix.

May-Wine Essence.—Coumarin, gr. iv.; spirit of orange (made with freshly grated orange peel), water, each f℥xij. Dissolve, mix, and if desirable colour with caramel. A few ounces are sufficient to flavour a gallon of Rhine or Californian wine.

Ethyl Bromide as an Anæsthetic. M. Rabuteau. (*Comptes Rendus*, lxxxiii., 1294.) The author gives some details of an investigation of the physiological properties and mode of elimination of bromide of ethyl.

Bromide of ethyl (C_2H_5Br), or "hydrobromic ether," is a colourless liquid, with an agreeable odour; it boils at about 40° C., has a density of 1·43, and burns with difficulty. The boiling point and density are therefore intermediate between those of chloroform and sulphuric ether.

Bromide of ethyl absorbed by the respiratory passages produces absolute anæsthesia as rapidly, or even more rapidly, than chloroform. This result has been established with frogs, rabbits, dogs, etc. After five minutes', sometimes after two minutes', inhalation, by means of a sponge saturated in bromide of ethyl, dogs are completely anæsthetized. The animals recover more rapidly than when chloroform is used.

When a solution of hydrochlorate of narceia or hydrochlorate of morphia was injected under the skin of dogs, before inducing anæsthesia, an action was observed analogous, but perhaps inferior, to the simultaneous action of narceia or morphia and chloroform.

Bromide of ethyl is not caustic, nor even irritant, compared to chloroform. It can be ingested without difficulty, and applied without danger, not only subcutaneously, but to the external auditory meatus and to the mucous membrane. In this respect it is preferable to chloroform, which is very caustic, and to sulphuric ether, of which the ingestion is nearly impossible. Introduced into the human stomach in doses of 1 to 2 grams, bromide of ethyl does not produce anæsthesia as when absorbed in sufficient quantity by the respiratory passages. It soothes pain, and does not disturb the appetite.

This anæsthetic is nearly insoluble in water. Nevertheless, water shaken with it acquires a pleasant taste and odour. Frogs, placed in water so saturated, undergo anæsthesia in ten or fifteen minutes.

Bromide of ethyl is eliminated nearly entirely, if not completely, by the respiratory passages, whatever may have been the mode of absorption. At most, only traces of it are found in the urine when it has been introduced into the stomach, and an extremely small quantity can be detected in that liquid when it has been inhaled. The author finds that bromide of ethyl does not decompose in the organism to form an alkaline bromide, such as bromide of sodium, a salt that is easily eliminated by the renal passages.

From his experiments, the author concludes that bromide of ethyl is an anæsthetic agent possessing properties intermediate between those of chloroform, bromoform, and ether.

Detection of Common Resin as an Adulterant in Shellac. F. Dietlen. (*Dingl. polyt. Journ.*, ccxxii., 190.) Shellac adulterated with common resin breaks with a shining instead of a dull fracture.

Ligroin dissolves common resin but not shellac, and may therefore be applied both for the detection and the quantitative estimation of the adulterant.

Hydrobromic Acid. Dr. J. Milner Fothergill. (*British Med. Journ.*, July 8, 1876.) The formula for the production of the acid in quantities of two quarts, is as follows:—Dissolve ℥x. ʒvj. gr. xxviij. of bromide of potassium in four pints of water; then add ℥xiij. ʒj. gr. xxxvij. of tartaric acid. The bitartrate of potash is precipitated, and the hydrobromic acid remains in a clear, bright, almost colourless fluid, possessing an acid taste, and the ordinary acid properties, as well as the peculiar properties of bromide of potassium as compared with any other salt of potash.

It prevents the occurrence of headache after doses of quinine, in those who before had to desist from taking quinine for that reason. It is, perhaps, not invariably successful, but its power is very marked. It also prevents the fulness felt in the head by some persons, especially those labouring under cerebral anæmia after doses of iron. It is also useful after nervous conditions, and, with quinine, is excellent in those cases when there is much nervous exhaustion from excessive indulgence in tea or in alcohol; this having been tried in a case of nervous excitability and sleeplessness where there had been much resort to chloral hydrate.

In forms of excited action of the heart, connected with general nervous excitability or nervous exhaustion, hydrobromic acid is most useful; given with quinine (of which it is a capital solvent) and digitalis, it gives better results than bromide of potassium and digitalis.

In all hysterical conditions connected with ovarian excitement, it seems to have all the properties of bromide of potassium. It is equally useful in the vomiting of pregnancy, and seems to exercise quite as powerful an influence over acts of reflex origin as does the bromide. It is especially adapted for the relief of menorrhagia associated with sexual excitement, and is even more effective here than the bromides themselves. It is also of use in whooping-cough, and combines conveniently with quinine, forming an effective measure in this troublesome affection; with spirit of chloroform and syrup of squill, it forms a most agreeable cough mixture of no mean potency. It is also of use in case of cough of reflex origin. When there is gastric irritability, it is the most useful of all acids, possessing the usual properties of acids generally, and of the bromine as well.

The dose of the acid, prepared as above, is one dram as a full dose; half a dram is the quantity ordinarily employed. Hydrobromic acid has the further advantage of not producing the troublesome eruption so often the result of doses of the bromide of potassium; at least so far as the author's experience has yet extended. There are many qualities about this acid to render it a useful member of our therapeutical armamentarium. Dr. Wade states that it is useful in the treatment of fever. It would seem the acid *par excellence* when there is much cerebral excitement in pyretic affections; but of this the author has no personal experience.

The Use of Salicylic Acid in the Household. Dr. von Heyden.

1. *Raw Meat.* — It frequently happens, especially in warm weather, that meat, particularly such as contains easily decomposable fat and blood (tongues, etc.), although otherwise irreproachable, upon closer examination or upon boiling, gives off a disagreeable smell. This may easily be removed, either by laying the meat, before cooking, in lukewarm water, containing

$\frac{1}{2}$ to 1 gram of salicylic acid to the litre, or by throwing some small crystals of acid into the water during the boiling.

When it is desired to preserve meat for some days, it is recommended to lay it in a solution of salicylic acid in water, $\frac{1}{2}$ to 1 gram to the litre; or to rub lightly salicylic acid into the meat, especially the bones and fat parts. The preservation, as well as the cleaning for the dressing, is done in the usual way.

Although meat treated with salicylic acid loses its red colour on the exterior, it undergoes no change internally. Moreover, it becomes tender with less boiling.

2. *Milk.*—Pure cows' milk, to which dry salicylic acid (not in aqueous solution) has been added, in the proportion of $\frac{1}{2}$ to 1 gram to the litre, curdles at the ordinary temperature after about thirty-six hours, retaining its properties, the cream separating and yielding butter perfectly.

3. *Preserved Fruits* (cherries, currants, raspberries, plums, apricots, peaches) may be prepared advantageously, by placing layers of fruit and sugar alternately, without water, in a not very wide mouthed pickle bottle, strewing over them a pinch of crystallized salicylic acid (about $\frac{1}{2}$ gram to a kilo. of contents), closing the jar with parchment paper that has been steeped in solution of salicylic acid, and boiling the bottles in the ordinary way in a water bath. Bilberries are best boiled without sugar, allowed to cool, filled into a narrow mouthed flask, some crystallized salicylic acid strewn over, corked, etc. Fruit thus preserved has been kept in excellent condition during two seasons. Another method is to lay over the surface of fruit preserved in bottles, a closely-fitting piece of blotting paper, that has been steeped in a strong solution of salicylic acid in rum. Preserved gherkins may be similarly treated. For those preserved in vinegar and sugar (*Essiggurken*), the salicylic acid is boiled with the vinegar, and when boiled poured over the gherkins. For salt gherkins (*Sauergurken*) the acid, $\frac{1}{2}$ to 1 gram to the litre, is added during the boiling; in other respects the preparation is as usual.

4. *Butter*, kneaded with water containing $\frac{1}{2}$ to 1 gram of salicylic acid to the litre, or packed in cloths saturated in such a solution, remains good longer than usual. Butter that has already become rancid, can be improved by careful washing with aqueous solution of salicylic acid (2 to 3 grams to the litre), and afterwards rinsing with pure water.

5. *Preserved Vegetables*, and similar articles, may also have a small quantity of crystallized salicylic acid added.

6. *Fumigation.*—Dry salicylic acid, volatilized from a hot plate, purifies the air and perfectly disinfects the walls of a closed room.

7. *Vessels, Corks,* etc., to which a disagreeable smell or taste attaches, are thoroughly purified by washing in solution of salicylic acid.

The solutions of salicylic acid for the above purpose are best prepared by rapidly boiling the acid in water, in the proportion of from 1 to 3 grams to the litre, and leaving to cool. Any excess that then separates is fit for fresh use; or if stirred up and used in suspension, causes a corresponding increase in the action of the solution.

Solubility of Silk in Alkaline Copper Solutions. J. Löwe. (*Dingl. polyt. Journ.*, 1876, 274.) Chloride of zinc, hydrochloric acid, and ammoniacal solutions of the hydrates of nickel and copper have been recommended as solvents for silk. The author prefers a solvent prepared by dissolving 16 grams of sulphate of copper in 150 grams of distilled water, and adding 10 grams of glycerin and so much solution of caustic soda that the precipitate at first formed is just redissolved. This solution, if made from pure materials and kept in a stoppered bottle, will remain free from the slightest decomposition for an indefinite period. Silk introduced into this solution soon swells up and then gradually disappears, forming a thick, mucilaginous solution, from which hydrochloric acid precipitates the silk as a whitish jelly. Coloured silk is generally as soluble in this liquid as the uncoloured; but silk dyed black with iron salts resists the solvent unless it be previously immersed in ammonium sulphide, washed with water, and treated with dilute hydrochloric acid to remove the iron.

Wool, cotton, and linen are not attacked by this solvent, not even after several hours' contact, and may therefore be detected and roughly estimated in mixed fabrics containing one or the other of these materials together with silk.

Formulæ and Preparations of New Medicaments. J. M. Maisch. (*Amer. Journ. Pharm.*, 1877, 233.) The recent French journals contain a number of formulæ which have been discussed before the Pharmaceutical Society of Paris, and from which the following are selections:—

Thymic Acid.—Add solution of potassa or soda to oil of thyme, agitate well for some time, separate from the uncombined hydrocarbon, decompose the alkaline solution by hydrochloric acid, wash the oily liquid with water, and purify by distillation. Thymic acid, or *thymol*, thus prepared, is liquid, of a weaker odour of thyme, little soluble in water, freely soluble in alcohol, possesses caustic properties, and has the composition $C_{10} H_{14} O$.

Solution of Thymic Acid (1 per mille).—Dissolve 1 gram of thymic acid in 4 grams of stronger alcohol, and add 995 grams of water. This solution is employed in lotions, injections, inhalations, etc.

Crystallized Aconita.—Powdered aconite root is exhausted by strong alchohol, containing one per cent. of tartaric acid; the liquid is distilled at a moderate heat, contact with the air being avoided; the residue is taken up with water to remove fatty and resinous substances, and then agitated with ether to remove colouring matter. An alkaline bicarbonate is now added to the acid aqueous solution until effervescence ceases, after which it is agitated with ether, the ethereal liquid concentrated and mixed with some light petroleum benzin, when the aconitia will be obtained in colourless rhombic or hexagonal tables, which are soluble in alcohol, ether, benzol, and chloroform, and insoluble in glycerin and the oils of petroleum. Its composition is represented by $C_{27} H_{40} N O_{10}$.

Crystallized nitrate of aconitia is readily obtained by neutralizing nitric acid, sp. gr. 1·42, with the alkaloid, and concentrating the solution; the crystals are voluminous.

Apomorphia.—1 part of pure morphia and 20 parts of pure hydrochloric acid are introduced into a strong tubular glass vessel, having at least fifteen times the capacity of the mixture; the open end is then carefully sealed, the tube introduced into a metallic tube, closed by a screw tap, and the whole immersed for three hours in an oil bath, heated to between 140° and 150° C. (near 300° F.). After cooling, the tube is opened (no gas being disengaged), the liquid diluted with water, and bicarbonate of sodium added in excess, whereby apomorphia mixed with morphia is precipitated. The liquid is decanted, and the precipitate exhausted by ether (or chloroform ?), which dissolves only the apomorphia. The ethereal solution is mixed with a few drops of hydrochloric acid, to precipitate crystalline chlorhydrate of apomorphia; the crystals are rapidly washed with some cold water, and recrystallized from boiling water. To obtain the new alkaloid from this hydrochlorate, its concentrated aqueous solution is precipitated by bicarbonate of sodium, the white precipitate is rapidly washed with a little cold water, and at once dried.

Thus prepared, apomorphia is a greyish amorphous powder, which is pretty freely soluble in water, the solution rapidly turning green in contact with air; its solution in syrup, kept in well-closed vials, does not undergo this change. It is distinguished from morphia by its complete solubility in ether and benzol; it is reddened by nitric acid, and turns brown with iodic acid, but ferric chloride imparts a rose (not a blue) colour. Composition $C_{17}\,H_{17}\,N\,O_2$.

Monobromated camphor is recommended to be prepared by pouring upon camphor contained in a retort a thin stream of bromine until the camphor is liquefied, heating by a water bath until bromhydric acid ceases to be given off, and crystallizing the residue from boiling alcohol.

CATAPLASM OF FUCUS CRISPUS.—A sheet of carded wadding is evenly spread out, a concentrated mucilaginous infusion of *Fucus crispus* (Irish moss) poured on it, and this covered with another sheet of wadding of the same size. By beating lightly with a brush the jelly is made to penetrate the wadding very evenly, and the whole is exposed to the moderate heat of a drying closet until the water has been expelled, when it resembles a sheet of thick cotton, and has acquired no odour. When intended for use, sufficient of the wadding is placed in a large plate and moistened with nearly boiling water, whereby the jelly swells considerably, the saturated solution of the emollient principles of the fucus remaining inclosed in the wadding.

SYRUP OF CHLORHYDROPHOSPHATE OF CALCIUM.—12·50 grams calcium phosphate (prepared by precipitating chloride of calcium with phosphate of sodium) are diffused in 340 grams distilled water, and just sufficient (about 8 grams) hydrochloric acid added to dissolve the calcium salt; 630 grams white sugar are dissolved in the liquid without heat, and 10 grams essence of lemon mixed with the strained syrup. Syrup of lactophosphate of calcium is prepared like the preceding from 12·50 grams calcium phosphate, sufficient (about 14 grams) concentrated lactic acid, 340 grams distilled water, 630 grams sugar, and 10 grams essence of lemon.

Syrup of acid phosphate of calcium is prepared in precisely the same manner, only substituting for the lactic acid a just sufficient quantity (about 18 grams) of phosphoric acid, sp. gr. 1·45.

The *solutions* corresponding to the three syrups above are made by employing 17 grams of the calcium phosphate, increasing the corresponding acid in proportion, and using enough distilled water to make the whole weigh 1000 grams.

GLYCERITE OF SUCRATE OF CALCIUM.—Mix 80 grams of burnt lime with 160 of sugar, and add in small quantities gradually 100 grams of water. After twenty-four hours, filter; add to the filtrate 160 grams glycerin, and enough water to make 1 litre.

Liniment of Sucrate of Calcium.—Olive oil, 200 grams; glycerite of sucrate of calcium, 100 grams. Mix.

Infusion of Coca.—Coca leaves, 10 grams; boiling water, 1000 grams.

Wine of Coca.—Bruised coca leaves, 30 grams; 60 per cent. alcohol, 60 grams. Macerate for twenty-four hours, then add wine (vin de Lunel), 1000 grams. Macerate for ten days with frequent agitation, and filter.

Elixir of Coca.—Coca leaves, 100 grams; 60 per cent. alcohol, 600 grams. Macerate for ten days; express strongly, and mix the liquid with 400 grams simple syrup; filter.

Extract of Coca is made by displacement with 60 per cent. alcohol, and evaporation to a soft extract.

Syrup of Coca.—Coca leaves, 100 grams; boiling water, 1000 grams. Infuse for twenty-four hours, express, filter, and dissolve 175 grams sugar in each 100 grams of the filtrate.

Iodinized Cotton.—2 grams of finely powdered iodine are sprinkled over 25 grams of cotton as uniformly as possible, which is then introduced into a wide mouthed, glass stoppered bottle that has been kept for a few minutes in nearly boiling water to expel some air. The stopper is then securely fastened, and the bottle heated for at least two hours to a temperature of 100° C., until the cotton has become uniformly impregnated with the iodine. The bottle must be allowed to cool before it is opened; and the cotton, which contains 8 per cent. of iodine, must be kept in glass stoppered vials. (See also *Year-Book of Pharmacy*, 1876.)

Diastase.—Malt, of which the germ has attained two-thirds the length of the barley grain, and dried at 50° C., is ground, macerated at the ordinary temperature for five or six hours with twice its weight of water; then expressed, filtered, and the liquid mixed with twice its bulk of 95 per cent. of alcohol. The precipitate is collected, spread in thin layers upon plates of glass, and rapidly dried in a current of air at a temperature of 45° C.

8·5 grams of diastase added to 200 grams of paste containing 10 grams of starch yield a liquid which filters very readily, and decolorizes five times its volüme of Fehling's solution.

Syrup of Chloral Hydrate.—Dissolve 50 grams of crystallized chloral hydrate in 950 grams of orange-flower syrup. A tablespoonful (20 grams) contains 1 gram of chloral hydrate.

Tincture of Quillaia.—100 grams of quillaia bark are digested in 500 grams of alcohol in a suitable apparatus, placed in a water bath, the temperature being maintained near the boiling point for half an hour; the whole is then macerated for 48 hours with occasional agitation, and afterwards filtered. The tincture is mainly employed in preparing emulsions of substances insoluble in water, such as *copaiba*, *tar*, *oil of cade*, which are made according to the formula for—

EMULSION OF TOLU BALSAM.—Dissolve 2 grams of balsam of tolu in 10 grams of 90 per cent. alcohol, add 10 grams of tincture of quillaia, and mix with 78 grams of hot water.

PREPARATIONS OF EUCALYPTUS GLOBULUS.—The infusion, wine, elixir, and extract are made from eucalyptus leaves, in the same manner as the corresponding preparations of coca. (see p. 303.)

Water of Eucalyptus.—Distil 1 part of dry eucalyptus leaves with sufficient water to obtain 4 parts of distillate.

Syrup of Eucalyptus.—Infuse 50 grams of eucalyptus leaves for three hours with sufficient water to obtain, after expression and filtration, 250 grams of infusion; add 100 grams of distilled eucalyptus water, and dissolve in the liquid 650 grams of sugar, using a covered vessel placed in a water bath.

TINCTURE OF PHYSOSTIGMA.—Macerate 100 parts of powdered Calabar bean in 500 parts of 80 per cent. alcohol for 10 days; express and filter.

GLYCERITE OF EXTRACT OF PHYSOSTIGMA is made in three different proportions. The alcoholic extract of Calabar bean is well mixed with 10, 20, or 100 times its weight of glycerin, and dissolved by the aid of a moderate heat. It should be completely dissolved.

BROMIDE OF IRON.—The solution of this salt does not keep well, and is at once made up into syrup or pills. It is made by using 40 grams of iron filings, 216 grams distilled water, and 80 grams bromine, and contains one-third its weight of ferrous bromide.

Pills of Ferrous Bromide.—15 grams of the preceding solution and 10 grams powdered iron are evaporated in a porcelain capsule, until the water has been driven off; the mass, while still hot, is transferred to a warm mortar, mixed with sufficient powdered gum arabic and licorice root until a mass is obtained, which is divided into 100 pills; they are to be rolled in lycopodium or covered with a mixture of gum and sugar.

Syrup of Ferrous Bromide.—15 grams of the solution are mixed with 985 grams of syrup of gum, flavoured with orange-flower water.

FERROUS CHLORIDE is made by dissolving iron in hydrochloric acid and evaporating the filtered solution rapidly to dryness.

Syrup of Ferrous Chloride.—Dissolve 5 grams of dry ferrous chloride in 20 grams of orange-flower water, and add 800 grams syrup of gum and 175 grams syrup of orange-flower.

Pills of Ferrous Chloride.—Dry ferrous chloride, powdered marshmallow-root, each 10 grams, mucilage sufficient. Make into 100 pills, which are to be silvered.

DIALYSED OXIDE OF IRON.—100 grams solution of ferric chloride of 30° B., are mixed in small quantities with 35 grams ammonia water of 22° B. The precipitate dissolves at first rapidly, afterwards very slowly. When the liquid has become transparent it is introduced into a dialysator, and this placed in distilled water, which is to be frequently renewed, until the liquid is no longer precipitated by nitrate of silver and is destitute of acid reaction. It still contains a small quantity of hydrochloric acid, which may be recognised by precipitating with ammonia, acidulating with nitric acid, and testing with silver nitrate. 10 c.c. of the liquid, which is entirely free from disagreeable ferruginous taste, are evaporated, and from the weighed residue the amount of water is calculated which must be added to obtain a solution containing in 100 c.c. 1 gram of solid matter.

SYRUP OF FERROUS CHLORHYDRO-PHOSPHATE.—Ferrous chloride, medicinal phosphoric acid, of each 5 grams; distilled water, 350 grams; sugar, 640 grams. Make a syrup.

SYRUP OF PYROPHOSPHATE OF IRON AND SODIUM.—Dissolve 25 grams of sodium pyrophosphate in 250 grams of distilled water, and 5 grams of dry ferric sulphate in 100 grams of water; add this last to the former solution, and in the clear and colourless liquid dissolve 620 grams of sugar.

The *solutions* of the last two preparations are obtained by omitting the sugar and adding enough distilled water to make 1 litre of solution.

GLYCERITES OF SUBNITRATE OF BISMUTH, of laudanum, of extract of lead, and of extract of rhatany are made with 90 parts glycerite of starch, by mixing it intimately with 10 parts of subnitrate of bismuth, of Sydenham's Laudanum, of Goulard's Extract, or of extract of rhatany, the latter to be previously dissolved in the smallest possible quantity of glycerin

TAR WATER.—The wood tar should be of a red-brown colour, transparent, and free from resinous deposits. Mix 5 grams of such tar intimately with 10 grams of pine-wood sawdust, and macerate for twenty-four hours with 1000 grams of distilled or rain water, stirring frequently.

SYRUP OF TAR.—15 grams of tar and 30 grams pine-wood sawdust are mixed, and digested at 60 ° C. with 1000 grams water, with occasional agitation. Filter at the end of two hours upon the sugar, 190 grams of which are to be used for every 100 grams of the filtrate, and effect the solution in a closed vessel, heating it by means of a water bath.

SYRUP OF IODOTANNIN (*Sirop Iodotannique*).—Dissolve 1 gram of iodine in 11 grams of 90 per cent. alcohol, add to syrup of rhatany (containing 2·5 per cent. of extract of rhatany) 988 grams, and mix well. The combination will be completed at the ordinary temperature in twenty-four hours, when the syrup has again its original colour.

IODINIZED SYRUP OF HORSERADISH is made in precisely the same way as the preceding, substituting the same weight of compound syrup of horseradish.

SYRUP OF IODIDE OF STARCH.—Dissolve 10 grams of soluble iodide of starch in 330 grams of distilled water, and use this solution for dissolving 640 grams of sugar, by the aid of a gentle heat.

PILOCARPINA.—The leaves or bark of *Pilocarpus pennatifolius* are exhausted with 80 per cent. alcohol, containing in the litre 8 grams of hydrochloric acid, and the tincture is distilled and evaporated to the consistency of a liquid extract, which is mixed with a small quantity of water, and filtered. The filtrate is treated with a slight excess of ammonia, and then with a large quantity of chloroform. The chloroform solution is agitated with water, to which hydrochloric acid is added, drop by drop, in sufficient quantity to neutralize the alkaloid, the hydrochlorate of which is obtained in long needles on evaporating the aqueous solution, while foreign principles remain dissolved in the chloroform. By dissolving the crystals in water, treating the solution with ammonia and chloroform, and evaporating the latter solution, pilocarpina is obtained as a soft viscous mass, which is little soluble in water, but freely soluble in alcohol, ether, and chloroform.

EFFERVESCING CARBONATE OF LITHIUM.—Take of citric acid 40 grams, bicarbonate of sodium 50 grams, and carbonate of lithium 10 grams. Powder and mix well, then introduce into a wide flat-bottomed dish, and heat to about 100° C. (212° F.), stirring constantly until the powder becomes granular. Separate the ganules of uniform size by means of appropriate sieves, and preserve them in well-stoppered bottles.

EXTRACT OF MALT.—Take of malt, the germ of which has attained two-thirds the length of the grain, dry at 50° C. (122° F.), grind and treat it with 2 parts of water at the ordinary temperature, stirring the mixture occasionally. After five or six hours express, strain, filter, and evaporate in a shallow dish at a temperature not exceeding 45° C. (113° F.)

SYRUP OF NARCEINA.—Dissolve 1 gram of narceina in 100 grams of water containing ·6 gram hydrochloric acid; add to the solution 250 grams of water, and then dissolve 650 grams of white sugar. Each tablespoonful of 20 grams contains ·02 gram ($\frac{1}{3}$ grain) of narceina.

PANCREATIN.—Pancreas is freed from foreign matters, bruised and mixed with water containing some chloroform, to prevent decomposition. After some time the mass is expressed, and the liquid filtered and evaporated rapidly in shallow dishes by means of a current of air, at a temperature not exceeding 45° C. (113° F.) ·10 gram of pancreatin disgested with 5 grams of fibrin and 25 grams of water, at a temperature of 50° C. (122° F.) for twelve hours, yields a solution which, when filtered, is scarcely rendered turbid by the addition of nitric acid. ·10 gram of pancreatin, added to 100 grams of paste containing 5 grams starch, yield a liquid which filters easily and decolorizes four times its volume of Fehling's solution.

FERROCYANHYDRATE OF QUINIA.—Four parts of quinia sulphate and enough distilled water to form a not too thick mixture are mixed with a concentrated solution of one part of ferrocyanide of potassium; the whole is heated to boiling for a few seconds, and then allowed to cool. The mother-liquor, from which more of the salt is obtained on concentration, is poured off from the resin-like mass, the latter washed with hot water and crystallized from boiling alcohol. It is in small yellowish needles, bitter, slightly soluble in water, freely in alcohol, and efflorescent in the air.

BROMHYDRATES OF QUINIA.—The *basic* salt is obtained by heating 10 grams of quinia sulphate with 80 grams of water to boiling, and adding 3·40 grams dry barium bromide, dissolved in 20 grams of water; the sulphate of barium is filtered off and the filtrate evaporated and crystallized. It forms silky needles, which require 60 parts of cold water for solution.

The *neutral* salt is made in a similar manner, except that the quinia is dissolved by the aid of just sufficient sulphuric acid, and 6·80 grams of barium bromide, dissolved in 25 grams of water, are used for decomposition; the mixture is heated to boiling, filtered, the filtrate evaporated to 35 grams, and crystallized. It crystallizes in handsome prisms, which are soluble in 7 parts of cold water, and freely soluble in alcohol and hot water. Both salts must be free from barium.

TANNATE OF QUINIA.—To a neutral solution of quinia salt add a solution of gallotannic acid, free from resinous matter, until the white precipitate is redissolved; neutralize exactly with solution of bicarbonate of sodium, whereby the quinia tannate will be precipitated; collect upon a filter, drain, dry, powder, and wash with distilled water; then dry again. It is a white amorphous powder, 3·5 parts of which correspond with 1 part of quinia sulphate; if prepared from the latter salt, it always retains a certain quantity of sulphuric acid.

LACTATE OF SODIUM is made by neutralizing lactic acid with sodium bicarbonate, and evaporating. It is very deliquescent.

SULPHOVINATE OF SODIUM.—1000 grams of sulphuric acid are carefully, and with constant agitation, added to 1000 grams of strong alcohol, and set aside for several hours; the liquid is then diluted with 4 litres of distilled water, neutralized with barium carbonate, and filtered from the precipitated barium sulphate. The filtrate is decomposed by a solution of sodium carbonate, and the filtrate concentrated in a water bath and set aside to crystallize; if necessary, the crystals are purified by recrystallization from water, and when dry preserved in well-stoppered bottles. The yield is about 1000 grams. The salt forms hexagonal tables, which are very soluble in alcohol and water, have a scarcely bitterish taste, and when heated to 120° C. (248° F.) liberate alcohol. Its aqueous solution is not precipitated by barium chloride or by potassium sulphate.

SYRUP OF HYPOPHOSPHITE OF SODIUM.—Dissolve 5 grams of the salt in 445 grams of simple syrup, and add 50 grams of orange-flower syrup. A tablespoonful weighing 20 grams contains 0·20 grams (3 grains) of sodium hypophosphite.

The Pharmaceutical Preparations of Physostigma. G. W. Kennedy. (Abstracted from a paper read at the fifth session of the American Pharmaceutical Association.) The writer does not favour the use of strong alcoholic preparations, as the active principle of Calabar bean is best extracted by a mixture of alcohol and water. The following embraces all the preparations of the bean which have hitherto been in use:—

Extractum Physostigmatis.

℞ Calabar Bean in moderately fine powder	12 troy ounces.
Alcohol (95 per cent.)	9 fluid ,,
Water (distilled)	3 ,, ,,
Glycerin	1 ,, ,,

Mix the alcohol, water, and glycerin together; moisten the powder with five fluid ounces of the mixture, pack in a conical glass percolator, and cover the surface of the powder with a disc of paper; pour on the balance of the mixture, cork the percolator, and cover closely, and set aside in a moderately warm place for four days, after which remove the cork, and proceed with the percolation, with a menstruum composed of three parts alcohol and one part water, until completely exhausted; distil off the alcohol, and evaporate in a porcelain vessel by means of a water bath to the proper consistence. The object of the glycerin is to keep the extract in a soft condition, which makes it more convenient for manipulation, and especially when it forms one of the component parts of a pill mass.

Extractum Physostigmatis Fluidum.

℞ Calabar Bean in moderately fine powder	16 troy ounces.
Alcohol (95 per cent.)	12 fluid ,,
Water (distilled)	4 ,, ,,

Moisten the powder with six fluid ounces of the above menstruum; pack in a conical glass percolator, after which cover the surface of the powder with a disc of paper, and pour upon it a sufficient quantity of the menstruum until the liquid begins to drop from the percolator; then close the lower aperture with a cork, and cover closely, and set aside in a moderately warm place for four days, after which the cork should be removed, and more menstruum added until thoroughly exhausted, the first twelve ounces being reserved, and the balance to be evaporated to four fluid ounces, and mixed with the reserved portion, and after standing a few days should be filtered through paper. This preparation is but little used, but makes an excellent basis for preparing calabarized paper or calabarized gelatin.

Tinctura Physostigmatis.

℞ Calabar Bean in moderately fine powder	4 troy ounces.
Alcohol (95 per cent.)	24 fluid ,,
Water (distilled)	8 ,, ,,

Mix the alcohol and water; moisten the powder with two fluid ounces of the menstruum; pack in a conical glass percolator, and cover the surface of the powder with a disc of paper, and pour six fluid ounces of the above menstruum on it; cork and cover the percolator closely, and allow it to remain in this condition four days, after which remove the cork, and proceed with the percolation and with the same menstruum until two pints of tincture are obtained, which will be found sufficient to thoroughly exhaust the bean. Some of the formulæ which have been published for making this preparation contain a much larger proportion of the bean. The writer's object in making it four troy ounces to the quart of tincture is to make it conform, in the proportion of solid material, with most other tinctures.

Calabarized Paper.

This is readily prepared by taking paper deprived of its size—thin letter paper, not ruled, is the best—and the size got rid of by boiling in water and drying. By dipping the paper three or four times in the fluid extract, and drying it after each immersion, the paper will be impregnated with a sufficient amount of the extract to perform the necessary service when applied to the eye. This plan of obtaining the effects of Calabar bean is objectionable, by being inconvenient, as it necessitates the removal of the paper subsequently. Calabarized gelatin is a much preferable preparation, for which the following formula is recommended:—

Calabarized Gelatin.

℞	Gelatin	30 grains.
	Water (distilled)	2 fluid ounces.
	Glycerin	gtt. xx.
	Fluid Extract Physostigma	♏ c.

Make a solution of the gelatin in the water and glycerin, and, while the solution is still warm, filter through paper in a warm funnel; add the fluid extract, and evaporate. When it is evaporated to the proper consistence, spread on a glass plate or marble slab, with edges slightly raised, and with perfectly even surface, and place another glass plate or slab on top, which will keep it even and smooth; when it is hard enough, remove the plates, and divide into one hundred equal squares of about an eighth of an inch square, or, as some might perhaps prefer, in circular form. The object here of the glycerin is to prevent its brittleness. The slabs should be slightly greased and warm, so as to prevent the shrinking and sticking of the gelatin. One of these small discs, containing about one grain of the bean, placed in the eye, will be immediately dissolved by the secretions, and the remedial agent absorbed, and the effects of the bean produced.

Physostigmine

is obtained by treating the extract as prepared according to the formula given, with a small quantity of dilute sulphuric acid, and diluting the mixture with water, filtering, and supersaturating with ammonium carbonate. The whole is now shaken with strong ether, and the ethereal solution which contains the alkaloid is separated after standing, which yields on evaporation the physostigmine in an impure condition, being contaminated with a red foreign matter, which obstinately adheres to it, and requires repeated solution in ether and crystallization to remove all the impurities.

The Syrups of Phosphates in General Use. E. C. Saunders. (*Pharm. Journ.*, 3rd series, vii., 41.) The chief reason for the difference met with in the various makes of the preparation known as "Parrish's Chemical Food" is to be found in the fact that the principal published formula, that in Parrish's "Pharmacy," is an utterly unpractical one. It is well known that glacial phosphoric acid uncontaminated with phosphate of soda is hardly to be found in the market at present; but even if it were, it is next to impossible to obtain a good preparation with it, as it is a monobasic acid, while the direction to add "*quantum sufficit*" of hydrochloric acid is exceedingly vague. But apart from this, it is evident that the formula cannot be strictly followed, as if the quantity of ferrous phosphate directed to be present in each fluid dram of the completed syrup is attended to, thirty-two troy ounces of sugar will have to be made into thirty-six fluid ounces of syrup,—a manifest impossibility; while if the quantity given as the amount of solution to be formed for the sugar to be dissolved in is adhered to, the result will be about forty-six fluid ounces of syrup, which will not contain the requisite amount per dram of iron and lime. All the formulæ at present in use seem merely modifications of that given by Parrish. In the following formula, the author has only followed Parrish as far as the result to be obtained is concerned, viz., that the finished syrup shall contain in each fluid dram one grain ferrous phosphate $Fe_3 P_2 O_8$, $2\frac{1}{2}$ grains calcic phosphate $Ca_3 P_2 O_8$, and traces of sodic and potassic phosphates, with free phosphoric acid.

℞	Iron Wire (clean, No 20)	240 grains.
	Syrupy Phosphoric Acid (sp. gr. 1·75),	3 oz. by weight.
	Water (distilled)	4 fluid ounces.

Mix the acid and water, and dissolve the wire in the mixture in a flask, loosely stopped with tow; the hydrogen evolved then protects the solution from oxidation. When all action has ceased.

heat to boiling point, and filter through paper in a funnel with a long neck reaching to the bottom of a beaker containing a little syrup, which floating on the iron solution will effectually prevent any oxidation.

℞	Slaked Lime (fresh)	923 grains.
	Phosphoric Acid (sp. gr. 1·75)	$9\frac{1}{2}$ oz. by weight.
	Water (distilled)	14 fluid ounces.

Mix the acid and water, and dissolve the lime in the mixture. Filter the solution.

℞	Crystallized Sodic Carbonate	54 grains.
	Potassic Carbonate	72 grains.
	Phosphoric Acid (sp. gr. 1·75)	$\frac{1}{2}$ oz. by weight.
	Water (distilled)	1 fluid ounce.

Dissolve and filter. Then mix all the solutions; and having added distilled water to make the solution measure 28 fluid ounces, dissolve in it, with heat, sugar, $3\frac{1}{4}$; powdered cochineal, 85 grains; and strain while hot. When cold add orange-flower water, 2 fluid ounces, and sufficient distilled water to make the whole measure 64 fluid ounces. The product is a nice clear syrup, entirely free from sulphate of soda, or ammonic chloride, both of which are by no means uncommon impurities--from the difficulty of washing the precipitates—when the syrup is made in the old way; while the whole process will be found very much less troublesome and tedious. Calcic hydrate is generally sufficiently pure as commonly obtained; though where the chemist has the facilities for doing it, it is best for him to make the lime himself, by igniting precipitated chalk in a crucible at a full red heat for an hour.

It may be remarked here that the last edition (1872) of Pereira's "Materia Medica" contains the astonishing information, on page 213, that "Hypophosphite of lime is an important constituent in Parrish's chemical food"—a statement that is liable to mislead physicians in a serious manner.

Easton's syrup is another preparation that is frequently badly made, and very often deficient in iron. The precipitate so frequently met with, in the form of phosphate of quinine, is probably always owing to the use of an acid containing metaphosphoric acid. The change in colour is due to exposure to the air, chiefly from oxidation of the iron salt, but partly to the quinine changing colour. It may be entirely avoided, as has been often remarked, by completely filling the bottles in which the syrup is kept, and corking so as to have as little air left in the bottle as possible.

No trouble will be found in making a satisfactory preparation if the following formula be strictly followed, and care taken to avoid exposure to the air of the iron solution.

℞	Iron Wire (No. 20)	240 grains.
	Phosphoric Acid (sp. gr. 1·75)	3 oz. by weight.
	Water	4 fluid ounces.

Dissolve, with the precautions directed above in the formula for Parrish's syrup.

℞	Quinine Sulph.	625 grains.
	Liq. Ammon.,	
	Distilled Water,	
	Dilute Sulphuric Acid	āā q. s.

Precipitate the quinine, *secundum artem*, and wash on a filter with a pint of very cold distilled water, press strongly, and dissolve in half an ounce by weight of phosphoric acid, diluted with an ounce of water in which sixteen grains of strychnine have been dissolved. Mix with the solution of iron, add enough distilled water to make the whole measure 10 fluid ounces, and mix thoroughly with 54 fluid ounces of simple syrup. The resulting syrup will contain in each fluid dram one grain ferrous phosphate, $Fe_3 P_2 O_8$; one grain quinic phosphate, $(C_{20} H_{24} N_2 O_2)_3 2 H_3 P O_4$, and $\frac{1}{32}$nd part of a grain of strychnine.

These two syrups afford good examples of two classes of syrups that present considerable difficulties in manipulation with the formulæ in general use, which are quite removed in the two just submitted. Both have now been tested on a large scale for some time, and found very satisfactory in their products. No originality is claimed in the use of metallic iron in place of precipitated ferrous phosphate. It was first suggested by Mr. H. W. Jones, in the columns of the *Pharmaceutical Journal*. The chief point is the importance of using tribasic (ortho) phosphoric acid, $H_3 P O_4$; both metaphosphoric acid, $H P O_3$, and pyrophosphoric acid $H_4 P_2 O_7$, if present in the acid to even a small extent, are certain to cause trouble. The precaution given as to filtering the solution of ferrous phosphate will be found useful in many other cases. A beaker full of solution of ferrous iodide filtered in a similar manner, with a layer of syrup the eighth of an inch thick floating on the surface, can be left exposed for twenty-four hours without injury to the solution. It is, of course, necessary that the solution should have the greatest specific gravity.

Coloured Fires. S. Kern. (*Chem. News*, Sept. 29, 1876.) In preparing coloured fires for fireworks according to the usual formulæ given in manuals of pyrotechny, it is often important to know the speed with which they burn; as in some cases, such as decorations and lances, they should burn slowly; whereas in others, such as wheels, stars for rockets, and Roman candles, they ought to burn quicker. The following tables are so arranged that every formula with a higher number yields a slower burning mixture than one with a lower number. Thus, No. 5 burns quicker than No. 6, and slower than No. 4.

Green-coloured Fires.

No.	Potassium Chlorate per cent.	Barium Nitrate per cent.	Sulphur per cent.
1.	36	40	24
2.	29	48	23
3.	24	53	23
4.	21	57	22
5.	18	60	22
6.	16	62	22
7.	14	64	22
8.	13	66	21
9.	12	67	21
10.	11	68	21
11.	10	69	21
12.	9·5	69·5	21
13.	9	70	21
14.	8·5	70·5	21
15.	8	71	21

Red-coloured Fires.

No.	Potassium Chlorate per cent.	Strontium Nitrate per cent.	Sulphur per cent.	Carbon Powder per cent.
1.	40	39	18	3
2.	32	46	19	2
3.	27	51	20	2
4.	23	55	20	2
5.	20	58	20·5	1·5
6.	18	60	21	1
7.	16	61·6	21·2	1·2
8.	15	63	21	1
9.	13	64	22	1
10.	12	65	22	1
11.	11	66	22	1
12.	10	67	22	1
13.	10	67·25	22	0·75
14.	9·25	68	22	0·75
15.	9	68·35	22	0·65

Violet-coloured Fires.

No.	Potassium Chlorate per cent.	Calcium Carbonate per cent.	Malachite Powdered per cent.	Sulphur per cent.
1.	52	29	4	15
2.	52	28	5	15
3.	52	26	7	15
4.	52	24	9	15
5.	52	23	10	15
6.	52	21	13	15
7.	51	20	14	15
8.	51	18	16	15
9.	51	16	18	15
10.	51	15	19	15
11.	51	13	21	15
12.	51	11	23	15
13.	51	10	24	15
14.	51	8	26	15
15.	51	6	28	15

Influence of Bottles on Wine. (*Pharmaceut. Centralhalle*, 1877, 126.) Wine of excellent quality has been observed to go bad in consequence of its action on the glass of the bottles in which it is kept. The glass in such a case ceases to be transparent. This observation has been confirmed by an investigation carried out by competent chemists at the instigation of the Chamber of Commerce at Bordeaux. From their report it appears that a good bottle glass, fully resisting the action of the wine, has the following chemical composition:—

Silica	58·4 per cent.
Potash and Soda	11·7 ,,
Alumina and Oxide of Iron . .	11·0 ,,
Lime	18·6 ,,

The glass which had proved injurious to the wine was found to contain:—

Silica	52·4 per cent.
Potash and Soda	4·4 ,,
Alumina and Oxide of Iron . .	11·1 ,,
Lime	32·1 ,,

The acids of the wine appear to act principally upon the lime. The best glass contains 18 to 20 per cent. of lime to 59–60 per cent. of silica; the worst 25 to 30 per cent. of lime to 50–52 per cent. of silica. In bottles of the latter composition the wine soon becomes thick and tasteless.

Phenicated Camphor. (*Pharm. Journ.*, 3rd series, vii., 756, and *Journal de Pharmacie* [4], xxv., 32, from the *Bulletin Therapeutique.*) The preparation which has been introduced by Dr. Soulez under this name is a simple solution of $2\frac{1}{2}$ parts of camphor in 1 part of carbolic acid. The liquid thus obtained is pale yellow, of an oleaginous consistency, and smells slightly of camphor, without any admixture of the carbolic odour. Phenicated camphor is insoluble in water, in glycerin, and in alcohol; but it dissolves in all proportions in the fat oils (olive and almond), and readily emulsifies with water containing saponin.

This preparation is recommended by Dr. Soulez as a preventive of fermentation in dressings for wounds. The dressings are steeped in a mixture of 10 parts of phenicated camphor and 200 parts of olive oil, or one of 10 parts of phenicated camphor and 200 parts of infusion of saponaria. The infusion may be prepared by pouring 1000 parts of boiling water upon 100 parts of saponaria leaves. Dr. Soulez, however, prefers to make a tincture by macerating 250 grams of *Quillaia saponaria* bark for ten days in a litre of 90° alcohol. This tincture, mixed with its weight of phenicated camphor, forms a concentrated emulsion, which is diluted with ten parts of water when required for use.

Cod Liver Oil and Ferrous Iodide. The following formula for this preparation has been published in the *Nieu Zydschrift voor de Pharmacie in Nederland*, by a commission which the Netherlands Pharmaceutical Society has appointed to examine secret remedies and specialities:—

℞	Iodine	1 part.
	Pulverized Iron	1 part.
	Pale Cod Liver Oil	80 parts.

Triturate the pulverized iron in a mortar with the iodine and one-fourth of the oil, and heat the mixture in a water bath with continual stirring, until the brown colour of the iodine has entirely disappeared and given place to a deep purple colour, showing that the ferrous iodide has been formed and dissolved. Then add the remainder of the oil, mix carefully, and after standing decant into dry bottles, which are to be completely filled, closed immediately, and kept sheltered from the light.

This oil is of a purple colour, and differs in taste but little from the ordinary medicinal cod liver oil. Exposed to the light it changes after a few days to a red-brown colour. Although the taste is but little altered, it is important to prevent this change of colour which always indicates the liberation of iodine. In well-stoppered bottles the oil remains unaltered; but it is as well not to prepare too much in advance. The taste and colour furnish good criteria for its condition.

Syrup of Liquorice Root. A. P. Brown. (From a paper read in the Philadelphia College of Pharmacy, October 7th: *Amer. Journ. Pharm.*, Nov., 1876, 487.) Having had occasion to prepare some ammoniacal glycyrrhizin, it occurred to the author that the use of ammonia in preparing syrup of liquorice root might be an advantage. He therefore devised the following formula:—

℞ Liquorice Root	4 troy ounces.
Cold Water	sufficient quantity.
Solution of Ammonia	1 fluid ounce.
Granulated Sugar	13 troy ounces.

Grind the root in a mill, and place it in a wide-mouth bottle, with a tightly fitting stopper; pour upon it one pint of water mixed with the solution of ammonia; macerate for forty-eight hours; then transfer it to a funnel, and allow the liquid to drain from it, and add sufficient water until two pints of liquid has passed; allow it to stand until the particles have subsided, then decant and evaporate to eight fluid ounces; filter, and having added the sugar, dissolve it with the aid of heat.

Experiments were made with the ordinary liquorice root and the Russian peeled root, and of the two the syrup made from the Russian root was decidedly the finest. The cortical portion of liquorice root is acrid, without possessing the peculiar virtues of the root; the Russian root, being deprived of the epidermis, will therefore make the best preparation.

The syrup thus prepared is of a dark brown colour, and contains all the sweet principles of the root without the starch and other inert matter. Sulphate of magnesium, iodide and bromide of potassium lose most of their taste when mixed with this syrup.

The author said he had also made and used ammoniacal glycyrrhizin to mask the bitter taste of quinine; two drams of the glycyrrhizin are dissolved in one pint of syrup, then to each fluid dram is added one grain of quinine sulphate. In making ammoniacal glycyrrhizin care must be observed to use chemically pure sulphuric acid in the precipitation; and in the preparation of the compound mixture of liquorice by the process suggested, an excess of ammonia must be avoided.

The author has also prepared a brown mixture from liquorice root and ammonia by the following process:—

℞ Liquorice Root	4 troy ounces.
Water of Ammonia	1 fluid ounce.
Water	sufficient quantity.

Proceed in the same manner as for syrup of liquorice root, but instead of evaporating to eight fluid ounces, evaporate to twelve fluid ounces, and mix this with the gum arabic, sugar, and other ingredients. Lastly, add water of ammonia until a clear solution is obtained, taking care not to add an excess. Brown mixture, prepared by the above process, is of a brownish yellow colour, and almost entirely free from sediment.

Croton Oil Pencils. M. Limousin. (*Répert. de Pharm.*, 1877, 129.) For the local application of croton oil the author recommends the use of pencils made according to the following formula:—Two parts of croton oil are added to one of cacao butter and one of white wax, melted over the water bath: when the mixture begins to cool it is poured into cylindrical moulds, in which it soon solidifies. Although the pencil only contains 50 per cent. of oil, still, owing to the avoidance of all loss through volatilization, the revulsive action of the drug is found to be even more powerful in this form than in its natural condition, and it has been successfully employed with the view of obtaining this action by Dr. Jules Simon at the Hôpital des Enfants Malades. Dr. Lailler has used these pencils in the treatment of tinea tonsurans. The pencils seem to retain their properties for several months.

Syrup of Coffee. R. H. Bernhardt. (*Druggists' Circular and Chemical Gazette*, Sept., 1876.) The preparation of this elegant syrup has long been within the province of the pharmaceutist; yet with all the various formulæ for its production contributed from time to time, it has not yet attained any appreciable degree of perfection. Its liability to fermentation has continually been a barrier to its more general adoption.

Syrup of coffee, like some other officinal syrups, is possessed of little or no medicinal value. Its importance as a pharmaceutical preparation lies exclusively in its remarkable power of disguising the taste of nauseous medicines, and the delicate flavour it imparts as an adjunct or diluent.

The following formula, in which is used the process known as "cold percolation," has been found after many experiments the most appropriate:—

℞ Roasted Coffee	2 troy ounces.
Crushed Sugar	28 troy ounces.
Distilled Water	sufficient quantity.

Moisten the coffee, previously reduced to a moderately fine powder, with half a fluid ounce of distilled water; introduce it into a conical glass percolator, and gradually pour distilled water upon it until sixteen fluid ounces of infusion have passed. Add this to the sugar contained in a glass percolator, in the orifice of which a piece of soft sponge has been introduced; and in order to prevent the immediate escape of the liquid, a cork is to be tightly fitted in the tube of the percolator at the bottom. The whole is then to be closely covered and set aside for about two hours, or until the sugar has dissolved down to half its former bulk. Then the cork can be removed and the liquid allowed to drop. If the liquid has all passed and there still remains a quantity of undissolved sugar in the percolator, pour it again upon the sugar until the desired result is effected. This last proceeding is, however, entirely unnecessary. and only occupies time; an essential precaution (and in this simple mechanical contrivance depends the success of the entire process) is to carefully insert the sponge in the orifice, not too tightly, but also not too loosely—*just sufficiently close to allow the syrup to pass drop by drop.*

It is also requisite to the immediate transparency of the preparation, that the infusion obtained by percolation should be perfectly clear. To accomplish this in the quickest and most convenient manner, it is only necessary to close the orifice of the percolator with a wad of dry, well compressed cotton, tightly inserted. It will be noticed that there is not the slightest degree of heat used in preparing this delicious syrup, further than in the parching of the coffee; and the transparency, reliability, and beauty of the product cannot be surpassed by any generally known formula.

The strength of this preparation can be made as individual fancy or desire may dictate. The above affords a very handsome dark brown coloured liquid, pretty well impregnated with the odour of coffee; and for ordinary purposes serves exceedingly well. For disguising the bitter taste of alkaloids, etc., the writer recommends a preparation double the strength of the above; this is easily obtained by simply substituting twice the amount (4 troy ounces) of coffee, and treating as directed in the general formula.

Fluid Extract of Jaborandi. F. V. Greene. (*Amer. Journ. Pharm.*, 1877, 395.)

℞ Jaborandi leaves, in moderately fine powder	16 troy ounces.
Alcohol (50 per cent.) . .	sufficient quantity.

Moisten the powder thoroughly with the menstruum, pack in a conical glass percolator, place a layer of two inches of well-washed sand on the top of the cloth covering the material, add menstruum until the liquid begins to drop from the percolator, when the lower orifice is to be closed with a cork, and the percolator, securely covered. set aside in a moderately warm place for four days. At the expiration of this time remove the cork, and add more menstruum by degrees until the material is exhausted. The first fourteen ounces of the percolate are to be reserved, and the remainder evaporated on a water bath, with constant stirring towards the close, to two fluid ounces, which are to be added to the reserved portion. If the percolation and evaporation have been properly performed, the fluid extract will not require to be filtered.

Mustard Paper. E. Disterich. (*Pharm. Post.*, August 16th, 1876, from *Chem. and Drugg.*, 1876, 393.) There are now few pharmacies in which mustard paper does not form part of the stock. and many physicians prescribe the use of it. Being officinal it is matter of astonishment that during the compilation of the Pharmacopœia, the claims which might reasonably have been advanced in favour of a well-made article were not put forward. Having noted down numerous observations made during the preparation of mustard paper, the author proposes to fill the hiatus.

A good mustard paper can only be made from a mustard flour, which has been so thoroughly freed from the fat oil, that not even a trace remains. In the other case, the article is less active, the mustard clings only lightly to the paper, and on being applied easily fixes itself to the skin; and lastly, such a paper loses its activity altogether by keeping, because of the development of rancidity in the fat oil. On the part of the manufacturer, the use of too high a temperature during the pressing or drying of the mustard meal would also cause failure. This may be determined by observing whether a small sample, when moistened, develops the odour of mustard oil. Whether, on the other hand, the mustard has been completely deprived of fixed oil; and therefore the paper prepared from it will retain its activity on lying by, is best ascertained by macerating some of the paper for an hour in petroleum benzin, and then filtering into a test-tube. If the column of liquid, on looking down through it vertically, is without colour, the removal of the oil is complete; but if golden yellow, the mustard, or mustard paper is to be avoided. The author here mentions that the fixed oil of mustard colours intensely yellow any solvent of it; and this characteristic is used as a test to determine the extent to which it has been removed from the meal. A paper prepared with meal not thoroughly free from oil, shows this yellow colour; a good paper should give a whitish grey colour. The action of the latter should also commence in forty seconds (at most in sixty seconds) from the time it is applied.

Essence of Vanilla. C. Becker. (*Amer. Journ. Pharm.*, August, 1876, 342.) The following formula is stated to give an excellent preparation:—

℞ Vanilla Beans	8 ounces.
Cut Loaf Sugar	72 ,,
Dilute Alcohol . . .	sufficient quantity.

Slice and cut very fine the vanilla beans; then with the sugar gradually added, reduce in a wedgewood mortar to a coarse powder (it should pass freely through a sieve of twenty meshes to the inch); pack this in to a cylindrical glass percolator, and *very slowly* displace with dilute alcohol 1 gallon of percolate. The first of this percolate is a dark syrup; and if the process is carefully conducted, the last few ounces of the gallon will pass almost void of colour or vanilla flavour.

Formulæ for Elixir of Monobromated Camphor.

1. The following formula is suggested by M. Dambier in the *L'Union Pharmaceutique*, xvii., 354:—40 grams of powdered sugar are dissolved by the aid of heat in 60 grams of alcohol of 56 per cent.; the solution is then filtered, and 0·5 gram of monobromated camphor dissolved in it with gentle heat. The preparation can be flavoured to suit the taste.

2. J. Mundy prefers glycerin to sugar, and suggests the following (*Pharm. Journ.*, 3rd series, vii., 712.):—

℞ Monobromated Camphor . .	30 centigrams.
Alcohol at 90°	12 grams.
Eau de fl. de Oranger	8 ,,
Glycerin	10 ,,

Mix the alcohol, glycerin, and orange flower water together, and dissolve the monobromated camphor by aid of a gentle heat.

In a subsequent paper, the same writer states that glycerin has not sufficient sweetening properties to overcome the nauseous taste, and introduces the following formula as answering better than the previous one:—

℞ Monobromated Camphor	℈j.
Sp. Cinnamon (1 in 50)	ʒv.
Red Elixir (U. S.)	ʒx.
Syrup, a sufficient quantity to make ℥iv.	

Mix the sp. cinnamon, red elixir, and syrup together, and add the monobromated camphor, and dissolve in a flask in a water bath; taking care to use no more heat than is absolutely necessary, or else the monobromated camphor will recrystallize.

The product contains two grains in each half-ounce, and the author thinks it will be found a convenient form for administering this drug where it is preferred in a liquid form.

He also gives a formula for a compound elixir which is frequently prescribed:—

Elixir Camph. Monobrom. Co.

℞	Croton Chloral	gr. iij.
	Tr. Gelsem. Semper.	♏ x.
	Monobromated Camphor	gr. ij.
	Sp. Cinnam. (1 in 50)	ʒss.
	Red Elixir	ʒiss.
	Syrup ad.	ʒss.

Dissolve the croton chloral in the sp. cinnamon, mix with the red elixir, gelsemium and syrup, and dissolve the monobromated camphor as directed for the simple elixir.

Santonate of Soda. M. Lepage. (*Journal de Pharmacie* [4], xxiv., 311; *Pharm. Journ.*, 3rd series, vii., 313.) Having failed to get satisfactory results with either of the two published processes for preparing santonate of soda, the author proposes the following *modus operandi*, which he finds to give a satisfactory result:—

℞	Powdered Santonin	100 grams.
	Alcohol (190°)	500 ,,
	Distilled Water	500 ,,
	Quick Lime	80 ,,
	Carbonate of Soda	90 ,,

Dissolve the santonin in alcohol and water at the temperature of a water bath; then add the lime, previously slacked and suspended in a very small quantity of water, and stir frequently. The liquid immediately takes a magnificent rose colour; but after about ten or fifteen minutes it loses its colour, and presents the appearance of a clear soup. This is due to the formation of santonate of lime, which is but slightly soluble in the alcohol and water. Allow the mixture to remain in the water bath some minutes longer, to insure the complete combination of the calcium oxide and santonin; then pour in the carbonate of soda dissolved in double its weight of pure water; agitate briskly, allow the liquor to deposit, and filter. Distil the filtrate in a water bath to recover the alcohol; concentrate the residue in a dish placed in hot water, until the consistence of a syrup, weighing 200 to 220 grams. After about twelve hours, when it has solidified, powder it and suspend it in 800 grams of 90° alcohol; agitate freely to facilitate solution, and after some hours of contact decant the clear liquid. Wash the portion remaining undissolved (excess of carbonate of soda) with 200 grams of fresh alcohol, and add this to the other alcohol, filter, distil to recover about three-fifths of the alcohol, and terminate the operation by concentrating the residue in a water bath until reduced to about 400 grams. Let this stand, and at the end of twenty-four to thirty-six hours it will form a crystalline mass of small prismatic needles, which after drying will weigh 150 to 160 grams. The mother-liquor, by further concentration, will still yield from 20 to 25 grams of the salt.

The santonate of soda thus obtained is perfectly white, and contains, according to the author's analysis, 51 per cent. of santonic acid. It dissolves completely in three parts of water, at the ordinary temperature, and in four parts of alcohol at 90° C. The aqueous solution possesses a marked bitter taste, and presents an alkaline reaction with litmus paper. No turbidity or precipitation should be caused by oxalate of ammonia, chloride of barium, or carbonate of soda. Acids added in slight excess precipitate the santonic acid.

Syrup of Santonate of Soda. The author recommends the following formula for a vermifuge syrup, which, from its taste resembling sugar syrup could be administered without difficulty to children:—

℞	Powdered Santonate of Soda	5 grams.
	Simple Syrup	900 ,,
	Syrup of Orange Flower	100 ,,

Suspend the santonate in 250 grams of the simple syrup, and heat it over a spirit lamp until dissolved; add the remainder of the syrup, then the syrup of orange flower, and mix carefully. A tablespoonful, or 20 grams, of this syrup will contain 10 centigrams of santonate, or the equivalent of 5 centigrams of santonin. For adults, the dose might be doubled, or a syrup made containing 20 centigrams to the tablespoonful.

Cosmolin Cream. E. J. Davidson. (*Amer. Journ. Pharm.*, March, 1877, 101.) An excellent substitute for cold cream may be obtained by the following formula:—

℞	Cosmolin	℥xxiv.
	White wax, Spermaceti	āā ℥xij.
	Glycerin	f ℥iij.
	Oil of Rose Geranium	f ʒj.

Melt the wax and spermaceti, add the cosmolin; then stir until nearly cold; add the glycerin and oil, and continue to stir until cold.

Extract of Malt. Dr. H. Hager. (From *New Remedies*, August, 1876.) Extract of malt has become a popular dietetic remedy, and is particularly esteemed as demulcent and nutritive food for children.

Its syrupy appearance, however, offers many inducements to fraud. The simplest and cheapest adulterant is glucose (syrup), which is in general used by brewers to increase the amount of extractive matter in beer. But there is no ready method known to detect this admixture. And as a complete analysis is in most cases impracticable, the consumer must generally rely upon the honesty of the manufacturer.

The author reports having received a sample of malt extract, which in external appearances resembled the genuine completely; although it had a peculiar faint, foreign taste. From its behaviour towards reagents, in which it greatly differed from the genuine, it was judged to be a mixture of glucose, glycerin, and about thirty per cent. extract of malt. To confirm these results, comparative reactions were make with three samples of extract of malt, one of which had been evaporated in an open vessel, and had a darker colour than the others. The main difference between extract of malt and glucose (syrup) is probably the amount of soluble modifications of protein-bodies in the former. It might be conjectured that the adulteration with glucose would produce a greater amount of reduction in alkaline copper solution. But the results obtained do not permit any such conclusion to be drawn; one gram of the three last-named extracts reducing respectively 43, 44·5, and 46 c.c. of the copper solution, while the submitted sample (X) reduced 48·5 c.c.

The presence of glycerin in moderate quantity, say up to 10 per cent., cannot be called an adulteration, as it is no doubt added for the purpose of preserving the extract; but then the glycerin must be employed in a pure state. The above-mentioned sample of extract (X), however, contained 26 per cent. of glycerin (extracted by ether-alcohol), which could not have been very pure, owing to the considerable quantity of calcium chloride present. The author considers the examination of the following points sufficient to decide on the genuineness and qualities of a malt extract.

1. The extract must have its own peculiar sweet taste and the refreshing odour of fresh bread.

2. The watery solution must be nearly clear. On dissolving 5 grams of the extract in 45 grams of distilled water, under stirring

and without heat, a slightly cloudy solution is obtained, which may be filtered without difficulty. The insoluble matters were found to be different under different circumstances, and consisted of amorphous coagulum, ferment-bodies, and columnar, four or six-sided (sometimes also star-shaped) crystals.

3. 10 c.c. of the filtered solution, prepared as just stated, are placed into a test-tube, 1·5 cm. ($=\frac{5}{16}$ inch) wide, and mixed with 10 c.c. of an aqueous cold saturated solution of picric acid. In the case of good extracts, a strong cloudiness appears at once, which gradually increases, and after ten minutes has become so intense as to prevent the passage of daylight through the liquid. The adulterated sample (X) showed only a slight cloudiness with picric acid, nor did it after ten minutes become so intense as to be impervious to light.

If it is desired to determine the quantity of the protein compounds in solution, 10 grams of the extracts are digested for half an hour at a gentle heat in 100 grams of cold saturated aqueous solution of picric acid, and the whole set aside to allow the precipitate to deposit. The latter is collected in a tared filter, washed, and dried in the water bath. Its weight, divided by 2, is approximately equal to the quantity of the proteides.

4. Another portion of the filtered 10 per cent. solution is mixed with tincture of galls in excess, and well shaken. A copious whitish precipitate, remaining suspended in the liquid and making it impervious to light, must make its appearance. Sample X gave only a slight cloudiness.

The same relationship which exists between pepsin and fibrin, or other animal protein-compounds, holds good between the diastase of extract of malt and vegetable starches. The latter, which form a main constituent of our vegetable diet, are converted by diastase into dextrin. Extract of malt, therefore, owing to its proteides and to diastase, is an excellent adjunct in the nutrition of infants.

Various other remedies have been combined with the extract of malt, to modify its action; or it is used as a pleasant disguise for disagreeable medicines. But since those agents which are capable of arresting or preventing fermentation would exert the same influence upon the diastase, and consequently would prevent the latter from acting upon starch, they should not be given in combination with malt extract, or at least only in very small quantities. Tannic acid, salts of quinine, salts of iron (ferric), with organic acids and potassium iodide, should be given in comparatively large quantities of the extract. Hager mentions the following compounds, or preparations, as in use in Germany:—

Extractum Malti Quinatum (*Malt Extract with Quinia*) was formerly prepared by adding 1 part of quinia sulphate to 250 parts of the extract; but the bitterness of the mixture caused it to be frequently rejected by children. At present the usual method is to add 1 part of quinia tannate to 100 parts of the extract. A trial with a perfectly neutral extract, prepared by J. D. Riedel, yielded a solution which had not deposited any sediment after eight days, and which exerted but a very slightly diminished action upon starch. Hager proposed to call this *Extractum malti tannochinatum.*

Extractum Malti Ferratum (*Ferrated Malt Extract*).—A formula for this preparation is given by the German Pharmacopœia. It is best prepared by dissolving 2 parts of soluble ferric pyrophosphate in 5 parts of pure glycerin, and adding it to 93 parts of the extract. The taste of the resulting product is, however, slightly modified, and Hager recommends to use saccharate of iron, 3 parts; glycerin, 7 parts; and extract, 90 parts. This would be *Extractum malti saccharoferratum.*

Extractum Malti Iodatum (*Iodized Malt Extract*) is a solution of 1 part of potassium iodide in 10,000 parts (rather dilute? Ed. *N.R.*) of extract.

Extractum Malti Pepsinatum (*Malt Extract with Pepsin*) is said to be more nutritious than the simple extract, and to be especially valuable in dyspeptic complaints. For this purpose a saccharated pepsin of 50 per cent. is recommended. Two parts of this are rubbed with 5 parts of glycerin, and added to 93 parts of the extract. It is best to prepare this mixture only when wanted.

Extractum Malti Lupulinatum (*Extract of Malt with Hops*) is a preparation made by J. D. Riedel, of Berlin. Although originally intended to be added to weak malt liquors or beers for the purpose of giving "body," it may be used medicinally. It has an agreeable aromatic taste, and is probably a solution of alcoholic extract of hops in extract of malt.

Substitute for Solution of Citrate of Magnesium. J. Rhinehart. (*Amer. Journ. Pharm.*, March, 1877, 101.)

℞	Acidum Citricum (in moderately sized crystals)	ʒj.
	Magnesii Sulphas	℥iss.
	Syrupus simplex	f ℥iij.
	Extractum Limonis	♏v.
	Potassii Bicarb. (in crystals)	gr. xl.
	Aqua pura, sufficient for	f ℥xij.
M.	Secundum artem.	

Place the acid and the epsom salts in a 12-oz. bottle; then add the simple syrup, water, and extract of lemon; lastly, add the potassium bicarb., and cork ready for use. By using the acid and potassium bicarb. in crystals the danger of losing carbonic acid gas is obviated, as the gas does not begin to generate before the cork can be firmly secured.

The above formula is much cheaper, more expeditious, and contains in a greater degree the required properties of a good, mild laxative, than does the officinal solution of magnesium citrate; it also has a very pleasant flavour, the bitter taste of magnesia being entirely absent.

Elixir Glycyrrhizæ. G. W. Kennedy. (*Amer. Journ. Pharm.*, May, 1877, 229.) An elixir by the above name has been introduced as an adjuvant to disguise and cover the extremely bitter taste of the chinchona alkaloids, epsom salt, and other nauseating and bitter medicines.

The following formula furnishes an excellent elixir:—

℞	Radic. Glycyrrhizæ opt.	℥ij.
	Spir. Vini rect. fort.	f℥vj.
	Aquæ	f℥vj.
	Syr. simplic.	f℥iv.
	Spir. Aurantii	fʒiss.
	Spir. Cinnamonii	♏viij.

The spirits are made by dissolving 1 fluid ounce of the oil in 15 fluid ounces of stronger alcohol.

Make a moderately coarse powder of the root, mix the alcohol and water, moisten the powder with the mixture, allow it to stand 12 hours, pack in a conical percolator, and pour on the balance of alcoholic mixture and sufficient diluted alcohol until 12 fluid ounces of percolate are obtained; then add the syrup, and finally the spirits of orange and cinnamon.

Alcoholic Solution of Shellac. A. Peltz. (*Pharm. Journ.*, 3rd series, vii., 94, from *Pharm. Zeitung für Russland.*) The production of a clear alcoholic solution of shellac has been the subject of numerous experiments; but hitherto none has turned out satisfactory except slow filtration. As is known, by digestion of one part of shellac with six or seven parts of 70 per cent. alcohol, a solution is obtained which, when warm, is almost clear, but on cooling becomes turbid, and is only partially clear after standing a week. The plan of pouring sufficient alcohol over coarsely powdered shellac to form a thin paste yields, upon the addition of more alcohol after the lapse of eight or ten hours, a liquor that does not deposit any more, but which is not clear. Another method suggested, of boiling the alcoholic shellac solution with animal charcoal, gives a clearer liquid, but there is always loss through absorption by the animal charcoal.

The object sought by the author was to obtain a clear alcoholic solution in a short time without much loss. Previous communications upon the substance occurring in shellac to the extent of five per cent., which renders its alcoholic solutions turbid, and is described by some authors as wax, and by others as a fat acid, suggested an attempt to effect its removal before dissolving the shellac. The shellac, therefore, was boiled with water, from one to five per cent. of soda or ammonia being added, but without satisfactory result; a somewhat larger addition of the alkali caused the solution of the shellac.

The author next prepared a solution with one part of shellac and six parts of 90 per cent. alcohol at the ordinary temperature, which was effected with frequent shaking in ten or twelve hours. To this he added carbonate of magnesia to about half the weight of the shellac used, and heated the mixture to 60° C. The solution so obtained cleared more rapidly than a solution to which magnesia had not been added, and filtered in less time; but it did not supply what was sought. When powdered chalk was substituted for magnesia, the solution after standing some hours became three-fourths clear, whilst the lower turbid portion could be rapidly filtered. It only required a little alcohol to wash the filter, and a clear alcoholic solution of shellac was obtained. Further experiments, for instance, with sulphate of baryta, did not give a better result. When such a solution is made on a large scale, it would be best filtered through felt.

Notwithstanding that the object of the author had thus been attained, one or two other experiments were tried. To three parts of the above-mentioned shellac solution, one part of petroleum ether was added, and the mixture was vigorously shaken. After standing a few moments the liquid separated in two layers: the upper light coloured layer was the petroleum ether, with the wax dissolved in it; the lower yellow brown layer was a clear solution of shellac, with only a little petroleum ether adhering. Upon allowing the petroleum ether to evaporate spontaneously, the wax that had been dissolved out of the shellac was obtained as a white residue. By using a stronger alcohol (95 per cent.) to dissolve the shellac, and subsequently adding petroleum ether, a perfectly clear solution was obtained, that only separated into two layers after the addition of water. Consequently, an alcohol weaker rather than stronger than 90 per cent. should be used.

The shellac solution obtained by means of petroleum ether, however, has the disadvantage that the shellac is left, after the evaporation of the petroleum, in a somewhat coarser form, and easily separates; this may be obviated by the addition of one to three per cent. of Venice turpentine.

Further experiments showed that the petroleum ether could be replaced by the ordinary commercial benzin.

Aromatic Elixir of Liquorice. J. P. Remington. (*Amer. Journ. Pharm.*, May, 1877, 231.) Since the remarkable property possessed by preparations of glycyrrhizin was noticed—of influencing the gustatory nerve, so that bitter and disagreeable substances can be administered without betraying their presence—several forms of using this valuable addition to the materia medica have been suggested. An aromatic elixir of liquorice has been one of the most desirable and successful of these attempts, and the author submits a formula which seems to be satisfactory :—

℞	Cinnamon	6	grams.
	Star Anise	4	,,
	Coriander	7	
	Caraway	7	,,
	Tonqua	4	,,
	Canella	2	,,
	Nutmegs	2	,,
	Cloves (all in fine powder)	2	,,
	Ammoniacal Glycyrrhizin	40	,,
	Oil of Orange (fresh)	2	,,
	Alcohol	532	,,
	Syrup	1000	,,
	Water	475	,,

Mix the oil of orange with the alcohol and water, and percolate the aromatics, recovering one thousand grams of percolate by pouring sufficient water upon the top to accomplish the purpose. Dissolve the ammoniacal glycyrrhizin in a small quantity of boiling water, and add to the rest after mixing with the syrup.

If an agreeable, simple elixir is at hand, the ammoniacal glycyrrhizin may be simply dissolved in it, in the proportion of one gram in fifty grams of simple elixir.

If it is desired to administer sulphate of quinia, all that is necessary is to pour into a teaspoon or glass a small quantity of the elixir, add the sulphate of quinia, and swallow before the bitter salt dissolves to any extent; then follow with a fresh teaspoonful of elixir, and the deception is complete.

A Convenient Mode of Producing Ozone. M. Linder. (*Pharmaceut. Centralhalle.*) A mixture of equal parts of manganese dioxide, potassium permanganate, and oxalic acid, when brought in contact with water, furnishes a good supply of ozone. Two spoonfuls of this powder placed on a dish and gradually mixed with water would be sufficient for a room of medium size. More water is added in small portions, from time to time, as the evolution ceases. The powder may be kept in a bottle ready for use.

Peroxide of Hydrogen as a Disinfectant. C. T. Kingzett. (*Pharm. Journ.*, 3rd series, vii., 450.) The extraordinary powers of hydrogen peroxide as a disinfecting and oxidizing agent have been known for a long time, but the complicated and tedious method of its preparation has been a bar to its adoption on a large scale. The author, in conjunction with Mr. Zingler, has recently instituted some experiments, based on certain researches on the hygienic influences of the pine and eucalyptus trees, by which they ascertained that by exposing a mechanical mixture of water and turpentine to a current of air at normal summer temperature, a solution containing hydrogen peroxide and camphoric acid—the result of splitting up of the turpentine—may be readily obtained. The solution is an aqueous one, containing no oil of turpentine; it appears to be non-poisonous, and is absolutely without harm to textile fabrics. It does not injure carpets or furniture when applied to them, and is slowly but perfectly volatile. It is hoped shortly to produce large quantities on a manufacturing scale, for use in watering roads and streets, and in private houses, hospitals, and other localities where prompt disinfectants are required.

Notes on Perfumery. W. Saunders. (From a paper read before the American Pharmaceutical Association.) The writer first refers to the ingredients entering into the composition of perfumes, and then gives the formulæ for the preparation of the latter.

Alcohol.—One of the first requisites in the manufacture of good perfumes is pure alcohol, free from fusel oil or other foreign flavour. This purer grade of spirit is known in commerce as pure spirits, silent spirits, or deodorized alcohol; and may readily be distinguished from ordinary alcohol by the absence of that peculiar pungency of odour which is present to a greater or less extent in most commercial samples.

Ottos or Essential Oils.—It is of the greatest importance that these should be strictly pure and of the finest quality.

Pomades.—From these are prepared some of the simple extracts in the appended formulæ, such as jasmine, tuberose, and cassia. The quality must be that known as triple pomade. The simple extracts are prepared as follows:—One pound of the pomade is cut in small pieces and placed in a bottle of sufficient capacity, in which is put a pint of pure spirit. Place the bottle suitably stoppered in a water bath, and apply heat sufficient to barely melt the pomade, shake well together, and repeat the shaking frequently until the fatty matter solidifies. In this way the pomade will be reduced to a finely divided or granular state, permeated thoroughly by the spirit. Allow this to stand for several days, giving it an occasional shake, then drain off the liquid extract into another bottle; if this fall short of a pint repeat the operation with a sufficient quantity of alcohol to make up to this measure. By subsequent and similar treatment, a second and even a third quantity of extract may be made, which, although much weaker, will be found useful in the preparation of cheaper perfumes.

Extract of Orris.—Seven pounds of finely ground orris root of good quality, is treated by percolation with pure alcohol until one gallon of extract is obtained.

Extract of Vanilla.—Four ounces of vanilla beans of the finest quality powdered finely in a mortar with a sufficient quantity of dry white sugar (from four to six ounces); pack in a percolator, and percolate with proof spirit until one gallon is obtained.

Extract of Tonka.—Take one pound of tonka beans, reduce to a coarse powder, and percolate with alcohol, to make one gallon.

Extract of Musk.—Take of pure grain musk of the first quality two drams. Mix half an ounce of liquor potassæ with four ounces of proof spirit, and triturate the musk with this mixture until it is thoroughly softened, and reduced to a creamy state; add enough proof spirit to make up about one pint; stir well, then allow the coarser particles to subside, and pour off the supernatant fluid. Rub the coarser portions again with a fresh portion of spirit, proceeding as before, and repeat the process until the musk is entirely reduced, and the quantity of extract measures three pints. Allow this to stand for a fortnight with occasional shaking, when it will be ready for use.

Extract of Styrax.—Eight drams of styrax balsam dissolved in one pint of alcohol.

Benzoic Acid.—Only that prepared from gum benzoin should be used.

FORMULÆ.

Jockey Club.

℞ Ext. Jasmin	5 ounces.
,, Orris	20 ,,
,, Musk	7 ,,
,, Vanilla	1½ ,,
Otto Rose, Virgin	1½ dram.
,, Santal. Flav.	1½ ,,
,, Bergamot	2½ ,,
,, Neroli Super	40 minims.
Benzoic acid	2 drams.

Pure Spirit, sufficient to make four pints.

In this, as well as in all the following extracts, before adding the last portion of the spirit, replace as much of it with water as the perfume will bear without becoming milky, which will vary from two to eight ounces or more. This addition will make the perfume softer.

White Rose.

℞ Otto Rose, Virgin	2 drams.
,, Red Cedar Wood (true)	6 minims.
,, Patchouli	4 ,,
,, Orange (fresh)	½ dram.
Ext. Tuberose	2 ounces.
,, Orris	2 ,,
,, Jasmin.	2 ,,
,, Musk	2 ,,
Benzoic Acid	1 dram.

Pure Spirit (to which four ounces of rose-water have been added), sufficient to make four pints.

Victoria.

℞ Otto Rose, Virgin	2 drams.
,, Neroli Super	2 ,,
,, Bergamot	4 ,,
,, Coriander	16 minims.
,, Pimento	24 ,,
,, Lavender, English	16 ,,
Ext. Jasmin	2 ounces.
,, Orris	16 ,,
,, Musk	2 ,,
Benzoic Acid	2 drams.

Pure Spirit, sufficient to make four pints.

Moss Rose.

℞ Otto Rose, Virgin	2 drams.
,, Santal. Flav.	2 ,,
Ext. Musk	12 ounces.
,, Vanilla	4 ,,
,, Orris	2 ,,
,, Jasmin	4 ,,
Benzoic Acid	1 dram.

Pure Spirit, sufficient to make four pints.

Patchouli.

℞ Otto Patchouli	2 drams.
,, Santal. Flav.	40 minims.
,, Rose, Virgin	40 ,,
Ext. Musk	8 ounces.
,, Orris	8 ,,
,, Vanilla	4 ,,
,, Styrax	2 drams.

Pure Spirit, sufficient to make four pints.

Millefleurs.

℞ Otto Rose, Virgin	1 dram.
,, Red Cedar Wood (true)	1 ,,
,, Orange (new)	1 ,,
,, Pimento	20 minims.
Ext. Orris	6 ounces.
,, Jasmin	2 ,,
,, Styrax	1 ,,
,, Tonka	4 ,,

Pure Spirit, sufficient to make four pints.

Ess. Bouquet.

℞ Ext. Musk	4 ounces.
,, Tuberose	2 ,,
Otto Rose, Virgin	1 dram.
,, Bergamot	1½ ,,
,, Neroli Super	½ ,,
,, Verbena (true)	8 minims.
,, Pimento	10 ,,
,, Patchouli	3 ,,
,, Red Cedar Wood (true)	½ dram.
,, Lavender, English	12 minims.

Pure Spirit, sufficient to make four pints.

Musk.

℞	Ext. Musk	1 pint.
	,, Orris	6 ounces.
	,, Vanilla	2 ,,
	,, Styrax	2 drams.
	Otto Santal. Flav.	1 ,,
	,, Bergamot	2 ,,
	,, Neroli Super	10 minims.
	,, Patchouli	12 ,,
	,, Lavender, English	15 ,,
	,, Cinnamon (true)	6 ,,

Pure Spirit, sufficient to make four pints.

Ylang Ylang.

℞	Ext. Tonka	3 ounces.
	,, Musk	4 ,,
	,, Tuberose	4 ,,
	,, Cassia	4 ,,
	,, Orris	8 ,,
	Otto Orange (new)	2 drams.
	,, Neroli Super	½ ,,

Pure Spirit, sufficient to make four pints.

Tuberose.

℞	Ext. Tuberose	24 ounces.
	,, Musk	4 ,,
	,, Jasmin	1 ,,
	Otto Rose, Virgin	1 dram.
	,, Neroli Super	10 minims.
	Benzoic Acid	2 drams.

Pure Spirit, sufficient to make four pints.

West End.

℞	Ext. Orris	12 ounces.
	,, Jasmin	4 ,,
	,, Musk	8 ,,
	,, Cassia	4 ,,
	,, Styrax	1 ,,
	Otto Bergamot	3 drams.
	,, Verbena (true)	15 minims.
	,, Neroli Super	½ dram.
	,, Rose, Virgin	1 ,,
	,, Red Cedar Wood (true)	1 ,,
	Benzoic Acid	1 ,,

Pure Spirit, sufficient to make four pints.

Wood Violet.

℞ Ext. Orris	12 ounce
,, Tuberose	2 ,,
,, Jasmin	1 ,,
,, Musk	4 ,,
Otto Bergamot	2 drams.
,, Lavender, English	1 ,,
,, Verbena (true)	10 minims.
,, Amygd. Amar.	12 ,,
,, Coriander	6 ,,
,, Sweet Flag	4 ,,
,, Bay Leaves	4 ,
Benzoic Acid	1½ ,,

Pure Spirit, sufficient to make four pints.

New-Mown Hay.

Ext. Tonka	25 ounces.
,, Musk	6 ,,
,, Orris	8 ,,
,, Vanilla	1 ,,
,, Styrax	1 ,,
Otto Bergamot	1 dram.
,, Neroli Super	15 minims.
,, Rose, Virgin	10 ,,
,, Cloves	6 ,,
,, Lavender, English	10 ,,
,, Patchouli	10 ,,
,, Santal. Flav.	1 dram.
Benzoic Acid	1½ ,,

Pure Spirit, sufficient to make four pints.

Rondeletia.

℞ Otto Lavender, English	1 ounce.
,, Cloves	½ ,,
,, Bergamot	½ ,,
,, Rose Geranium, Turkey	2 drams.
,, Cinnamon (true)	20 minims.
,, Rose, Virgin	10 ,,
,, Santal. Flav.	1 dram.
Ext. Musk	2 ounces.
,, Orris	4 ,,
,, Vanilla	2 ,,
Benzoic Acid	1 dram.

Pure Spirit, sufficient to make four pints.

Stephanotis.

℞	Ext. Cassia	4 ounces.
	,, Tuberose	4 ,,
	,, Jasmin	2 ,,
	,, Musk	8 ,,
	,, Orris	8 ,,
	,, Tonka	3 ,,
	Otto Rose, Virgin	1 dram.
	,, Neroli Super	½ ,,
	Benzoic Acid	1 ,,

Pure Spirit, sufficient to make four pints.

Frangipanni.

℞	Ext. Orris	4 ounces.
	,, Tuberose	2 ,,
	,, Musk	4 ,,
	,, Vanilla	2 ,,
	,, Jasmin	1 ,,
	,, Styrax	1 ,,
	Otto Neroli Super	1 dram.
	,, Rose, Virgin	½ ,,
	,, Santal. Flav.	1 ,,
	,, Red Cedar Wood (true)	1 ,,
	,, Pimento	½ ,,
	,, Cassia	20 minims.
	,, Bergamot	½ dram.
	,, Ginger	4 drops.
	,, Lavender, English	6 ,,
	Benzoic Acid	2 drams.

Pure Spirit, sufficient to make four pints.

Clove Pink.

℞	Ext. Jasmin	12 ounces.
	,, Orris	12 ,,
	,, Musk	8 ,,
	Otto Rose, Virgin	1 dram.
	,, Cloves	2 ,,
	,, Neroli Super	1 ,,
	,, Pimento	10 minims.
	,, Patchouli	20 ,,
	,, Santal. Flav.	2 drams.
	Benzoic Acid	1 ,,

Pure Spirit, sufficient to make four pints.

Spring Flowers.

℞ Ext. Orris	4 ounces.
,, Jasmin	4 ,,
,, Musk	4 ,,
Otto Bergamot	2 drams.
,, Neroli Super	½ ,,
,, Verbena (true)	10 minims.
,, Red Cedar Wood (true)	1 dram.
Benzoic Acid	1 ,,

Pure Spirit, sufficient to make four pints.

Violet.

℞ Ext. Orris	2 pints.
,, Tuberose	4 ounces.
,, Vanilla	3 ,,
,, Musk	3 ,,
,, Tonka	2 ,,

Pure Spirit, sufficient to make four pints.

Camphorated Phenol as an Application. (*Zeitschr. des oesterr. Apoth. Ver.*) 12 grams of camphor are dissolved in an alcoholic solution of 2 grams of carbolic acid; with this solution pieces of lint are moistened and applied in a number of layers to the affected part. To prevent evaporation the lint is covered with gutta percha tissue. The application relieves pain, and may be used as a substitute for Lister's dressing.

Mixtures of Quinine and Ammonia. William McIntyre. (*Amer. Journ. Pharm.*, November, 1876, 488.) While quinine and ammonia are generally incompatible, an excess of the latter will determine a solution, and several pharmaceutical preparations of this character are now in use.

The following formulæ of ammoniacal solutions of quinine have been published :—

Liquor Quiniæ Ammoniatus (Bastick).

[Now officinal in the B. P.]

℞ Sulphate of Quinine	32 grains.
Alcohol, 49 per cent.	3½ fluid ounces.
Solution of Ammonia	½ fluid ounce.

Diffuse the quinine in half the spirit, add ammonia to the remainder, and mix all together.

Tinctura Quiniæ Ammoniata (Ince).

℞	Sulphate of Quinine	32 grains.
	Alcohol, 49 per cent.	3½ fluid ounces.
	Spirit of Ammonia	½ fluid ounce.

The increased alcoholic strength is considered an improvement by the author.

Liquor Quiniæ Ammoniatus (Squire).

℞	Sulphate of Quinine	32 grains.
	Strong Solution of Ammonia	1 fluid dram.
	Alcohol, 49 per cent., sufficient to make	4 fluid ounces.

Mix as in the first formula.

Tinctura Quiniæ Ammoniata (Curtis).

℞	Quinine (alkaloid)	32 grains.
	Aromatic Spirit of Ammonia	4 fluid ounces.

The quinine will readily dissolve in the spirit, and the strength of the preparation can be increased, if desired. These solutions are permanent; with water they make turbid mixtures, and are too pungent to be taken undiluted.

The following, which is taken from Squire's "Pharmacopœias of the London Hospitals," agrees with the three first formulæ in quinine strength, but is notably stronger in ammonia and alcohol.

Liquor Quiniæ Ammoniatus.

℞	Sulphate of Quinine	24 grains.
	Strong Solution of Ammonia	4 drams.
	Rectified Spirit (sp. gr. 838)	to 3 ounces.

Dose: 30 to 60 minims.

Black Writing Inks. C. H. Viedt. (*Dingl. polyt. Journ.*, ccxvi., 453.) The aqueous solution of the tannin of the gall nuts undergoes the following change by fermentation, the ferment being present in the Aleppo galls:—

$$\overset{\text{Tannin.}}{C_{27} H_{22} O_{17}} + 4 H_2 O = \overset{\text{Gallic Acid.}}{3 (C_7 H_6 O_5)} + \overset{\text{Sugar.}}{C 6 H_{12} O_6}.$$

On boiling the nuts with water, and exposing the solution to the air, this fermentation sets in. The Chinese galls do not contain this ferment, and therefore to bring about the above decomposition some yeast must be added. Concentrated solutions of ferous salts give, with tannic acid, a white voluminous precipitate; in dilute solutions no change takes place. Ferric oxide solutions, with excess of tannic acid, give a blue-black precipitate of ferroso-ferric tannate, a part of the higher oxide being reduced to the lower one. This ferroso-ferric tannate is also formed when solutions of ferrous tannate are exposed to the air, partial oxidation taking place. With great excess of tannic acid even ferric salts give no precipitate, being thus reduced to ferrous salts. After a long time the solution becomes blue-black; later on blue-black tannate is precipitated, the solution remaining of a dirty green colour. By boiling a mixture of a ferric salt with tannic acid, it becomes colourless, with liberation of carbonic acid ; and thus it becomes evident that prepared gall-nut inks ought never to be heated to boiling. The behaviour of gallic acid to iron salts is nearly analogous to that of tannic acid. Ferrous salts have no effect on gallic acid, but on exposure to air the solution becomes at first reddish, then violet, then dark blue, and at length an insoluble and blue-black ferroso-ferric gallate is precipitated. This insoluble gallate precipitates much more quickly than the corresponding tannate, but the supernatant solution of the gallate remains somewhat strongly coloured with gallate retained in solution. In choosing tannic acids for the manufacture of ink, it should be remembered that only those giving blue reactions with iron yield the best coloured inks; those which give a green colour, as sumach tannic acid, cannot be recommended. Many of the former variety also contain substances which damage the colour of the ink; as the tannic acid of the *Tormentilla erecta*, which contains an injurious red pigment besides tannic acid.

Gall nuts are considered the best source of the tannic acid; and of these the Chinese galls, with 72 per cent. of tannin, are recommended as cheapest and best, because they also contain less extractive mucilaginous bodies than the Aleppo galls; they furnish an ink less liable to become mouldy. To extract the tannic acid from the gall nuts they are coarsely pulverized, and mixed with an equal quantity of straw cut small. This mixture is shaken in a high, narrow vessel of oak wood, furnished with a tap at the bottom, and close above a perforated false bottom. Here it is treated with lukewarm water, and the tannic acid extract is allowed to flow very slowly out, after which it is returned several times, still further to exhaust the powdered galls. The mixture of chopped straw is to obviate the difficulty caused by the swelling of the galls on lixiviation, and the yielding of a quantity of slimy mucilage, which would otherwise have rendered the mass impermeable. It is suggested that a row of small "diffusers," similar to those employed by the sugar-refiner, might be used with even greater advantage.

To preserve the prepared ink from mildew, three to five drops of pure *carbolic acid* should be added, or if the smell of this be objected to, *salicylic acid*. The presence of lime in the water used for ink making is not injurious. The ferrous salt recommended is ferrous sulphate, "green vitriol;" the proportions will be 100 *parts of tannin to 90 parts of crystallized ferrous sulphate*. Of course, by the use of the pure ferrous salt the ink at first is very light coloured, though it afterwards darkens on exposure to air. To overcome the difficulty of this pale writing, the ink is coloured with logwood extract, or some soluble colouring matter. Logwood and cupric sulphate are used for ink making, besides gall nuts and ferrous sulphate. Both yield beautiful blue-black precipitates; galls and cupric sulphate, however, give a slimy brown-black colour, which spoils the tint of the ink. It is better, therefore, not to use the copper salt at all.

Detection of the Principal Colouring Matters Employed in the Sophistication of Wines. M. G. Chancel. (*Compt. Rend.*, February 19th, 1877; *Chemical News*, xxxv., 106.) The author takes 10 c.c. of wine, and adds 3 c.c. of a dilute solution of subacetate of lead, allowing the mixture to subside for a few minutes, to make sure that the precipitation is complete. If this is not the case, a slight excess of the reagent is added. After stirring and heating for a few moments, it is thrown on a very small filter, the filtrate collected in a test-tube, and the precipitate washed three or four times in hot water. If the filtrate is coloured magenta is present, and may be sought for by the aid of the spectroscope. But if the wine contains a mere trace of this colour, it is retained in the precipitate, and is sought for in the manner directed below. To discover the colouring matters which may be contained in the plumbic precipitate, it is treated upon the filter with a few c.c. of a solution of carbonate of potassa (2 parts of the dry salt to 100 of water), taking care to repass *the same solution* several times through the precipitate. Any magenta present is thus extracted, along with carminamic (ammoniacal cochineal) and sulphindigotic acid. The colouring matters of logwood and of alkanet remain undissolved. With a genuine wine the alkaline liquid takes a very faint yellow, or greenish yellow tint. For the detection of magenta the filtrate is mixed with a few drops of acetic acid, and it is then shaken up with amylic alcohol. The magenta dissolves in this alcohol with a fine rose tint, and its presence is proved by spectroscopic examination.

Carminamic and sulphindigotic acids remain in the aqueous solution, and are decanted off. A couple of drops of sulphuric acid are added, and the mixture is again shaken up with amylic alcohol, which now dissolves the ammoniacal cochineal. It may be detected by the spectroscope. The sulphindigotic acid remains undissolved in the amylic alcohol, and may be found in the blue aqueous residual liquor by means of the spectroscope. Logwood is most conveniently sought for in a fresh portion of the wine by digestion with a little precipitated carbonate of lime, adding a few drops of lime-water, and filtering. In a natural wine the filtrate has a faint greenish yellow colour, but if logwood is present it takes a fine red shade, and the absorption-bands of logwood may be detected with the spectroscope. On treating the lead precipitate above mentioned with an alkaline sulphide, washing with boiling water, and then treating with alcohol, the colouring matter of alkanet, if present, is dissolved, and may be detected by spectroscopic examination .

Syrupus Maticæ et Radicis Granati. M. Perret. (*Pharm. Zeitung*, xxi., 733.) This preparation is very strongly recommended in diarrhœa, dysentery, and internal hæmorrhage. It is prepared by infusing 20 grams of matico leaves, and 120 grams of pomegranate root bark, with 1200 grams of boiling water, allowing the infusion to stand in a covered vessel for twelve hours, then straining, pressing, and heating the strained liquid with 2000 grams of sugar.

TRANSACTIONS

OF THE

British Pharmaceutical Conference

AT THE

FOURTEENTH ANNUAL MEETING

AT

PLYMOUTH.

1877.

EDITED BY

PROFESSOR ATTFIELD.

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British Pharmaceutical Conference.

CONSTITUTION.

Art. I. This Association shall be called The British Pharmaceutical Conference, and its objects shall be the following:—

1. To hold an annual Conference of those engaged in the practice, or interested in the advancement, of Pharmacy, with the view of promoting their friendly reunion, and increasing their facilities for the cultivation of Pharmaceutical Science.
2. To determine what questions in Pharmaceutical Science require investigation, and when practicable, to allot them to individuals or committees to report thereon.
3. To maintain uncompromisingly the principle of purity in Medicine.
4. To form a bond of union amongst the various associations established for the advancement of Pharmacy, by receiving from them delegates to the annual Conference.

Art. II.—Membership in the Conference shall not be considered as conferring any guarantee of professional competency.

RULES.

1. Any person desiring to become a member of the Conference shall be nominated in writing by a member, and be balloted for at a general meeting of the members, two-thirds of the votes given being needful for his election. If the application be made during the recess, the Executive Committee may elect the candidate by a unanimous vote.

2. The subscription shall be 7*s.* 6*d.* annually, which shall be due in advance upon July 1.

3. Any member whose subscription shall be more than two years in arrear, after written application, shall be liable to be removed from the list by the Executive Committee. Members may be expelled for improper conduct by a majority of three-fourths of those voting at a general meeting, provided that fourteen days' notice of such intention of expulsion has been sent by the Secretaries to each member of the Conference.

4. Every association established for the advancement of Pharmacy shall, during its recognition by the Conference, be entitled to send delegates to the annual meeting.

5. The Officers of the Conference shall be a President, four Vice-presidents by election, the past Presidents (who shall be Vice-presidents), a Treasurer, two General Secretaries, one local Secretary, and nine other members, who shall collectively constitute the Executive Committee. Three members of the Executive Committee to retire annually by ballot, the remainder being eligible for re-election. They shall be elected at each annual meeting, by ballot of those present.

6. At each Conference, it shall be determined at what place and time to hold that of the next year.

7. Two members shall be elected by the Conference to audit the Treasurer's accounts, such audited accounts to be presented annually.

8. The Executive Committee shall present a report of proceedings annually.

9. These rates shall not be altered except at an annual meeting of the members.

10. Reports on subjects entrusted to individuals or committees for investigation shall be presented to a future meeting of the Conference, whose property they shall become. All reports shall be presented to the Executive Committee at least fourteen days before the annual meeting.

⁂ *Authors are specially requested to send the titles of their Papers to either of the General Secretaries two or three weeks before the Annual Meeting. The subjects will then be extensively advertised, and thus full interest will be secured.*

FORM OF NOMINATION.

I Nominate

Name)..

(Address)..

as a Member of the British Pharmaceutical Conference.

.... *Member.*

Date..

The nomination must be legibly written, and forwarded to one of the Honorary General Secretaries, Prof. Attfield, 17, Bloomsbury Square, W.C., or F. Baden Benger, F.C.S., 7, Exchange Street, Manchester, either of whom, or any other officer or member, will duly sign the paper.

Pupils and Assistants, as well as Principals, are invited to become members.

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Professor Dragendorff, Pharmaceutische Institut, Dorpat, Russia.
Professor Albert E. Ebert, Corner of State and Twelfth Streets, Chicago, Illinois, U.S.A.
Dr. John Baker Edwards, Ph.D., F.C.S., Box 398½, Post Office, Montreal, Dominion of Canada.
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Professor J. M. Maisch, 1607, Ridge Avenue, Philadelphia.
Professor G. F. H. Markoe, Professor of Pharmacy in the Massachusetts College of Pharmacy, U.S.A.
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MEMBERS RESIDING ABROAD.

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Ambrosse, Mr. J. D. L., Corner of M'Gill and Notre Dame Streets, Montreal, Canada (Year-Books, per enclosure, Messrs. J. Campbell & Son, St. Bride Street, E.C., to Mr. W. Drysdale, Montreal).
Alexander, Mr. J. L., Bathurst, New South Wales.
Allen, Mr. C., 532, George Street, Sydney, N.S.W. (Year-Book per Messrs. Maw, Son, & Thompson.)
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Egan, Mr. Miles, Hyde Park Terrace, Sydney, N.S.W.
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Hamilton, Mr. J., Regent Street, Sydney, N.S.W.

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Hughes, Mr. J., Corner of Elizabeth and Devonshire Streets, Sydney, N.S.W.

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Jackson, Mr. W. H., 252, George Street, Sydney, N.S.W. (Year-Book to Messrs. A. S. Hill & Co., 101, Southwark Street; for enclosure to Mr. Senior, 252, George Street, Sydney, N.S.W.).

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Kemp, Mr. D. S., 5, Elphinstone Circle, Bombay (Letters, etc., to Mr. W. B. Davis, 106, Leadenhall Street, E.C.).

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Leslie, Mr. J., Port Elizabeth, Cape of Good Hope.

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Parker, Mr. J., jun., Anson Street, Orange, N.S.W.

Pedler, Prof. A., 14a, Sudder Street, Chowringhee Road, Calcutta.

Petit, Monsieur A., Rue Favart, 8, Paris.

Penney, Mr. H., Paramatta Street, Sydney, N.S.W.

Plimmer, Mr. W. T., L.H.C.L., Fort, Bombay (Letters, etc., to Messrs. Treacher & Co., 38a, King William Street, E.C.

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Saunders, Mr. E. C., 281, Maine Street, Memphis, Tennessee, U.S.A.
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Ward, Mr. M., Queen Street, Brisbane, Queensland.
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Weekes, Mr. N., 219, Pitt Street, Sydney, N.S.W.
Whitford, Mr. H. F., Grafton, Sydney, N.S.W.
Wills, J. L., F.C.S., Piedimielera, Val d'Ossola, Italy.
Wiltshire, T. P., F.C.S., Room 8, 271, Broadway, New York.
Wood, C. H., F.C.S., Government Cinchona Plantations, Rungbee, near Darjeeling and Calcutta, India (Letters, etc., to Mr. Baldock, 3, High Street, S. Norwood, S.E.).
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Zambeletti, Sig. L., 5, Piazza San Carlo, Milan, Italy.

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PROFESSOR ATTFIELD, *Hon. Gen. Sec.*,
17, *Bloomsbury Square*,
London, W.C.

LIST OF MEMBERS.

For Alphabetical List of Towns, see page 391.]

Abbott, Mr. J., 145, Woodhouse Lane, Leeds.
Abraham, Mr. J., 87, Bold Street, Liverpool.
Abram, Mr. F. W., Market Place, East Dereham, Norfolk.
Ackerman, Mr. T., 39, Redcliff Hill, Bristol.
Adam, Mr. T., 440, St. Vincent Street, Glasgow.
Adams, Mr. A. A., Woolston, Southampton.
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Adams, Mr. R. W., Park Place, Dover.
Adlington, Mr. W. B., 6, Weymouth Street, Portland Place, W.
Agar, Mr. W., Westgate, Mansfield.
Ainslie, Mr. W., 58, George Street, Edinburgh.
Aitken, Mr. J., 44, Broughton Street, Edinburgh.
Aitken, Mr. R., 338, Oxford Street, W.
Alcock, Mr. H., Market Street, Tunstall, Staffs.
Alexander, Mr. J., 81, Athol Street, Liverpool.
Allanson, Mr. C., Montpelier Parade, Low Harrogate.
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Allchin, Mr. A., England House, Primrose Hill Road, N.W.
Allen, A. H., F.C.S., 1, Surrey Street, Sheffield.
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Allen, Mr. W. H., 108, Patrick Street, Cork.
Allen, Mr. W. H., 3, Liverpool Terrace, Canning Town, Essex.
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Anholm, Dr. A., 11, Smeaton Street, Hull.
Appleby, Mr. C., Market Place, East Retford.
Appleby, Mr. E. J., 8, Argyle Street, Bath.
Applegate, Mr. E., 5, Hercules Terrace, Holloway Road, N.
Appleyard, Mr. R., 50, Park Lane, Bradford.
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Archer, Mr. J. S., Guiseley, Leeds.
Archer, Prof. T. C., Museum of Science and Art, Edinburgh.
Archibald, Mr. G. T., 56, Low Church Street, Workington.
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Armstrong, Prof., H. E., F.R.S., London Institution, Finsbury Circus, E.C.
Armstrong, Mr. J., Newgate Street, Bishop Auckland.
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Arnold, Mr. A., Commercial Arcade, Guernsey.
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Asquith, Mr. W. C., Market Street, Colne.
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Atkins, Mr. W. S., 106, Broad Street, Birmingham.
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Atkinson, Mr. L., 121, Greenwich Road, S.E.
Atmore, Mr. G., High Street, King's Lynn, Norfolk.
Attenborough, Mr. H. R., Address unknown.
Attfield, Prof. J., Ph.D., F.C.S., 17, Bloomsbury Square, W.C.
Attwood, Mr. A., 147, Cannon Street, E.C.
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Bagshaw, Mr. W., 37, Terrace Buildings, Yorkshire Street, Oldham.
Baigent, Mr. W. H., Clifton Road, Shefford, Beds.
Baildon, Mr. H. B., 73, Princes Street, Edinburgh.
Baildon, Mr. H. C., 73, Princes Street, Edinburgh.
Bailey, Mr. J. B., 9, Coley Hill, Reading.
Bailey, Mr. J. H., 3, Mornington Terrace, Wanstead, E.
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Baine, Mr. J. A., 9, West Blackhall Street, Greenock.
Baker, Mr. C. P., High Street, Chelmsford.
Baker, Mr. F., Harnet Street, Sandwich.
Baker, Mr. G., High Street, Cosham, Hants.
Baker, Mr. P. C., Magdalen Street, Norwich.
Baker, W., F.C.S., 46, High Street, Sheffield.
Balch, Mr. E., 25, Queen Street, Ramsgate.
Balchin, Mr. E. S., 135, Penton Place, Newington Butts, S.E.
Balcomb, Mr. J., 10, Suffolk Parade, Cheltenham.
Baldock, J. H., F.L.S., F.C.S., 3, High Street, South Norwood, S.E.
Balkwill, Mr. A. P., 106, Old Town Street, Plymouth.
Ball, A., M.R.C.S., St. Leonards, York.
Ball, Mr. E., 1, Spring Gardens, Buxton.
Ball, Dr. T., Belfast.
Ball, Mr. W., 65, Russell Street, Landport.
Balls, Mr. G., 189, High Street, Deptford, S.E.
Baly, Mr. J., 40, High Street, Warwick.
Bamford, Mr. J. W., 37, Cronkeyshaw Road, Rochdale.
Bancks, Mr. A., Guisbro', Yorks.
Banfield, Mr. H. W., 5, Lower Clapton Road, E.
Bannerman, Mr. C. A., Market Square, Lytham, Lancs.
Bannister, R., F.C.S., F.R.M.S., Inland Revenue Laboratory, Somerset House, W.C.
Bannister, Mr. W., 108, Patrick Street, Cork.
Barber, Mr. G., 27, Botanic Road, Liverpool.

Barclay, Mr. T., 17, Bull Street, Birmingham.
Barker, Mr. C. D., 51, White Ladies' Road, Clifton, Bristol.
Barker, Mr. R., 2, Meadow Place, Mold, Flint.
Barker, Mr. W. R., 143, New Bond Street, W.
Barnard, Mr. J., 338, Oxford Street, W.
Barnes, Mr. B., 57, St. Peter's Street, Derby.
Barnes, J. B., F.C.S., 1, Trevor Terrace, Princes Gate, W.
Barnett, Mr. A., 5, The Colonnade, Buxton, Derbyshire.
Barnitt, Mr. F., Old Bond Street, Bath.
Barnitt, Mr. J., 86, The Parade, Leamington.
Barr, Mr. R., Gourock, N.B.
Barraclough, Mr. T., Roscoe Terrace, Chapeltown Road, Leeds.
Barret, Mr. E. L., 53, Springfield Road, St. John's Wood, N.W.
Barrett, F. J., F.C.S., Messrs. Wyley's & Co., Coventry.
Barrett, Mr. T. G., Church Street, Ilchester.
Barron, Mr. F., 1, Bush Lane, E.C.
Barron, Mr. W., 37, Winchcomb Street, Cheltenham.
Bartle, Mr. W. F., 47, Blackfriars Road, S.E.
Barton, Mr. A., Campbeltown, Argyleshire.
Barton, Mr. A. F. G., 115, Edge Lane, Liverpool.
Barton, Mr. H. E., High Street, Kenilworth.
Barton, Mr. H., 77, King's Road, Brighton.
Barton, Mr. S. W., Nevill Street, Southport.
Bascombe, Mr. F., 172, New Bond Street, W.
Bassett, Mr. C., Taff Street, Pontypridd.
Batchelor, Mr. C., 90, West Street, Fareham, Hants.
Bateman, Mr. T. H., 5, The Pavement, Forest Hill, S.E.
Bates, Mr. J., 214, High Street, Deritend, Birmingham.
Bates, Mr. J., Wellington, Salop.
Bates, Mr. W. I., 116, Mill Street, Macclesfield.
Bateson, Mr. T., 23, Stricklandgate, Kendal.
Bathe, Mr. R. S., 7, Lower Terrace, Notting Hill, W.
Bathgate, Mr. W. L., 23, Canning Place, Liverpool.
Battersby, Mr. S., Cheapside, Lancaster.
Batting, Mr. T. G., 98, The New Parade, Calverley Road, Tunbridge Wells.
Baxter, Mr. G., 13, Foregate Street, Chester.
Bayley, Mr. G. H., 12, Victoria Road, Saltaire, near Leeds.
Bayley, Mr. J. T., Brownhills, near Walsall.
Baynes, J., F.C.S., Laboratory, Royal Chambers, Scale Lane, Hull.
Beach, Mr. J., Bridport.
Beal, Mr. E. J., Ilford.
Beamish, Mr. G. P., Ditchley, Little Island, Cork.
Beanland, Mr. S., 11, Arctic Parade, Great Horton, Bradford, Yorks.
Beardsley, Mr. J., Nottingham.
Beaumont, Mr. C. F. J. B., 1, High Street, Chislehurst, S.E.
Beetham, Mr. M., 7, Promenade Villas, Cheltenham.
Belfield, Mr. W., 267, Stamford Street, Ashton-under-Lyne.
Bell, Mr. C. B., 6, Spring Bank, Hull.
Bell, Mr. F., 36, Tyrrel Street, Bradford.
Bell, Mr. F. E., Tow Law.
Bell, Mr. F. R., Sussex Street, Middlesboro-on-Tees.
Bell, Mr. G., Market Place, Hexham.
Bell, Mr. J. A., Ashton, near Preston.
Bell, Mr. R. E., 161, East Street, Walworth, S.E.
Bell, Mr. T., Ambleside.
Bell, Mr. W., Victoria Villa, Padford Road, Leamington.
Bell, Mr. W. H., 96, Albany Street, N.W.
Bellamy, Mr. R., Bedale.
Bellerby, Mr. M., 25, Shield Street, Newcastle-on-Tyne.

Benger, F. B., F.C.S., 7, Exchange Street, Manchester.
Bennet, Mr. J. D., Address unknown.
Bennett, Mr. G., 10, Bridge Street, York.
Bennett, Mr. H., 112, Upper George Street, Kingstown.
Bennett, Mr. J., 14, Waterloo Road, Widnes, near Warrington.
Bennett, Mr. R., 3, King Street, Sheffield.
Bennett, Mr. S., Tunstall, North Staffs.
Benson, J. L., Ph.D., 115, West Parade, off Spring Bank, Hull.
Bentley, Prof. R., F.L.S., 17, Bloomsbury Square, W.C.
Bernays, Dr. A. J., F.C.S., St. Thomas's Hospital, S.E.
Berry, Mr. E., The Cross, Gloucester.
Berry, Mr. T., 189, Henshaw Street, Oldham.
Berry, Mr. W., 15, Albert Villas, Cotham, Bristol.
Best, T. F., F.C.S., 66, Aldersgate Street, E.C.
Betty, Mr. S. C., 1, Park Street, Camden Town, N.W.
Bevan, Mr. C. F., Church Street, Harwich.
Bibbings, Mr. J. H., Aqua Villa, Manning's Hill, Newton Abbot.
Bickerdike, W. E., F.C.S., Surbiton Place, Preston New Road, Blackburn.
Bicknell, Mr. W., 97, Ebury Street, Pimlico, S.W.
Biddiscombe, Mr. C., 60, St. James's Place, Plumstead, S.E.
Bienvenu, Mr. J., Southampton.
Biffin, Mr. T., 156, Clapham Road, S.W.
Billing, Mr. T., 86, King's Road, Brighton.
Billington, Mr. F., 127, Wavertree Road, Liverpool.
Bindloss, Mr. G. F., 97, Leighton Road, N.W.
Bing, Mr. E., 41, George's Street, Canterbury.
Bingley, Mr. J., Northampton.
Binnie, Mr. R., 137, High Street, Dumbarton, N.B.
Birch, Mr. H. C., 7, Church Road, Upper Norwood, S.E.
Bird, Mr. A., Wood Lane, Shepherd's Bush, W.
Bird, Mr. W. L., 10, Alexandra Villas, Uxbridge Road, Acton, W.
Birkett, Mr. J., 16, The Crescent, Morecambe, Lancs.
Bishop, Mr. A., Specksfields, Booth Street, E.
Bishop, Mr. W. B., Specksfields, Booth Street, E.
Bishop, Mr. W. M., 233, High Street, Lincoln.
Blabey, Mr. J. J., Allerton Road, Woolton, near Liverpool.
Black, Mr. J., 7, Bothwell Circus, Glasgow.
Blackhurst, Mr. W. S., Poulton Street, Kirkham.
Blackshaw, Mr. T., 35, Market Place, Burslem.
Blades, Mr. F., 10, Gloucester Road, W.
Bladon, Mr. W. G., Blackmore House, Malvern Wells.
Blagmire, Mr. T. C., 2, St. Ann's Square, Manchester.
Blain, Mr. A. H., 341, Upper Parliament Street, Liverpool.
Blain, Mr. W., Market Street, Bolton.
Blair, Mr. R. P., 230, South Street, Perth.
Bland, Mr. H., 33, Newborough Street, Scarborough.
Bland, Mr. J. H., 75, High Street, Stourbridge.
Blankley, Mr. W., Arnold, Nottingham.
Blanshard, Mr. G., Smith's Place, Edinburgh.
Blatchley, Mr. T., Yeadon, Yorks.
Blelock, Mr. C. J., Bridge Street, Chester.
Bletsoe, Mr. J., 124, Southampton Row, W.C.
Blood, Mr. C., Formby, Lancashire.
Bluett, Mr. W. R., 237, Amherst Road, Hackney, E.
Blyton, Mr. J., 43, Heywood Street, Cheetham, Manchester.
Bolam, Mr. J., 38, Northumberland Street, Newcastle-on-Tyne.
Bollans, Mr. E., Leamington.
Bolton, Mr. C. A., 1, Goosegate, Nottingham.
Bond, J. K., B.A., F.L.S., 42, Park Street, Plymouth.

Boor, Mr. F., Fallowfield, Manchester.
Boorne, Mr. C., Union Street, Bristol.
Booth, Mr. J., 5, Darwen Street, Blackburn.
Booth, Mr. J., Elmfield, Rochdale.
Booth, Mr. J., Heckmondwike.
Booth, Mr. R., Parliament Row, Hanley.
Booth, Mr. W. G., 30, Swan Street, Manchester.
Booth, W. H., M.R.C.S., St. James's Street, Sheffield.
Borland, Mr. J., 7, King Street, Kilmarnock.
Bordass, Mr. J., Market Place, Driffield, Yorks.
Borthwick, Mr. A. J., Market Place, Selkirk.
Borrett, Mr. H., Harleston, Norfolk.
Bostock, Mr. W., Sylvester House, Ashton-under-Lyne.
Botham, Mr. G., Medical Hall, Levenshulme.
Botham, Mr. J., 180, Bury New Road, Manchester.
Botham, Mr. W., 19, Old Haymarket, Sheffield.
Bottle, A., F.C.S., Townwall Street, Dover.
Bottrill, Mr. G. T., 208, Freeman Street, Grimsby, Lincs.
Boucher, Mr. J., Union Street, Bristol.
Bourdas, Mr. I., 7, Pont Street, S.W.
Bourdas, Mr. I., jun., 48, Belgrave Road, S.W.
Bowden, Mr. W., 76, Liverpool Road, Patricroft, Lancashire.
Bowker, Mr. W., 20, Manor Street, Bolton.
Bowles, Mr. W. J., 3, Newland Terrace, Kensington Road, W.
Bowling, Mr. J. H., 1, Dimond Street, Pembroke Dock.
Boyce, Mr. G., Chertsey.
Boyce, Mr. J. P., Peascod Street, Windsor.
Braby, F., F.C.S., F.G.S., M.R.I., Mount Henley, Sydenham Hill, S.E.
Braddock, Mr. H., 33, Queen's Road, Oldham.
Bradley, Mr. F., 17, Cross Street, Shepherdess Walk, N.
Bradley, Mr. T. D., 2, Allestree Villas, Derwent Grove, Dulwich, S.E.
Bradshaw, Mr. J., Adlington, near Chorley, Lancashire.
Brady, Mr. A., 29, Mosley Street, Newcastle-on-Tyne.
Brady, H. B., F.R.S., 29, Mosley Street, Newcastle-on-Tyne.
Braithwaite, Mr. J. C., 38, Gloucester Street, N.W.
Branson, Mr. F. W., 1, Eversfield Place, St. Leonard's-on-Sea.
Brayshay, Mr. T., 38, High Street, Stockton-on-Tees.
Brayshay, Mr. W. B., 38, High Street, Stockton-on-Tees.
Brearey, Mr. W. A., Prospect Hill, Douglas, Isle of Man.
Breeze, Mr. G., 36, Catherine Street, Devonport.
Bremner, Mr. J., Buckie, Banffshire, N.B.
Bremridge, Mr. R., 17, Bloomsbury Square, W.C.
Brevitt, Mr. W. Y., Darlington Street, Wolverhampton.
Brewster, Mr. W., Market Place, Kingston-on-Thames.
Bridgman, Mr. W. L., St. Mary Church, Torquay.
Brierley, Mr. J., 23, Bridge Street, Burton-on-Trent.
Bright, Mr. R., 29, Broad Bridge Street, Peterboro.
Brightmore, Mr. W., 237, Maida Vale, W.
Broad, Mr. J., Rise House, Hornsey Rise, N.
Broad, Mr. J. M., Rise House, Hornsey Rise, N.
Brockbank, Mr. E., Settle.
Brockett, Mr. R. H., 41, Northumberland Street, Newcastle-on-Tyne.
Brodie, Mr. R., 253, Crown Street, Glasgow.
Brook, Mr. R., 11, Silver Street, Halifax.
Brooke, Mr. C., 5A, Walcot Street, Bath.
Brooke, Mr. T., Aire Street, Leeds.
Brookes, Mr. F. J.
Brooks, Mr. C., 355, Wandsworth Road, S.W.
Broom, Mr. G., Llanelly, Carmarthenshire.
Broughton, Mr. A., 99, Meadow Lane, Leeds.

Brown, Mr. A. H., Shanklin, I. of W.
Brown, Mr. A. J., 55, Trafalgar Terrace, Greenwich, S.E.
Brown, Mr. D., 93, Abbey Hill, Edinburgh.
Brown, Mr. E., 66, Woodhouse Lane, Leeds.
Brown, Mr. E. W., Thrapstone, Northamptonshire.
Brown, Mr. G., Sandown, Isle of Wight.
Brown, Mr. G. B., 48, Church Street, Sheffield.
Brown, Mr. H., 40, Aldersgate Street, E.C.
Brown, Mr. H. F., 3, Princess Road, South Norwood, S.E.
Brown, Mr. J., 187, Mill Street, Great Ancoats, Manchester.
Brown, Mr. J. F., 4, Market Square, Dover.
Brown, Mr. R. D., Loose Hill, Loose, near Maidstone, Kent.
Brown, Mr. W. B., 100, Fishergate, Preston, Lancs.
Brown, Mr. W. S., 113, Market Street, Manchester.
Brown, Mr. W. H., 83, Tyne Street, North Shields.
Brownen, G., F.C.S., 6, Althorpe Road, Wandsworth Common, London, S.W.
Bryant, Mr. R. W., Alford, Lincs.
Buchanan, Mr. J., 52, North Bridge, Edinburgh.
Buchanan, Dr. T. D., 24, Westminster Terrace, Glasgow.
Buck, Mr. J. M., 179, Bedford Street South, Liverpool.
Buck, Mr. R. C., 192, Breck Road, Liverpool.
Buckett, Mr. A. H., 16, Market Place, Penzance, Cornwall.
Buckle, Mr. C. F., 77, Gray's Inn Road, W.C.
Buckley, Mr. R. C., Todmorden.
Bulgin, Mr. W., New Road, Gravesend.
Bull, Mr. B., High Street, Royston, Herts.
Bullen, Mr. T., 13, Hereford Road, Bayswater, W.
Bullock, Mr. F., 5, Hawkhurst Terrace, Anerley Road, Anerley.
Bullock, J. L., F.C.S., 3, Hanover Street, W.
Bulmer, Mr. T. P., 4, Low-Ousegate, York.
Burch, Mr. W., High Street, West Bromwich.
Burden, Mr. E. M., 38, Duke Street, Grosvenor Square, W.
Burdon, Mr. J., Claypath, Durham.
Burdwood, Mr. J., 30, Frankfort Street, Plymouth.
Burgess, Mr. R., Winsford, Cheshire.
Burkinshaw, Mr. W. T., Belper, Derbyshire.
Burlinson, Mr. T., Central Hall, Sunderland.
Burn, Mr. D. H., High Street, Arbroath.
Burns, Mr. W., 109, High Street, Ayr, N.B.
Burrell, Mr. G., 116, High Street, Montrose.
Burrows, Mr. H. C., 29, Leadenhall Street, Leicester.
Burt, Mr. G. E., 76, York Place, Westminster, S.W.
Burt, Mr. J., 61, Montague Street, Worthing.
Burton, Mr. J. D., 397, Cambridge Road, E.
Burton, Mr. S., 10½, High Cross Street, Leicester.
Bury, Mr. J., 9, King Street, Manchester.
Busby, Mr. H. H., 1, High Street, Dulwich Road, Penge, S.E.
Busby, Mr. J., Harpenden, Herts.
Bush, Mr. T., Paulton, near Bristol.
Bushby, Mr. T., 41, Stockport Road, Manchester.
Butler, Mr. E. H., Humberstone Gate, Leicester.
Butler, Mr. J., jun., Great Bridge, Tipton.
Butt, E. N., F.C.S., 13, Curzon Street, W.
Butterworth, Mr. A., 37, Wakefield Road, Bradford, Yorks.

Caley, Mr. A. J., Bedford Street. Norwich.
Callaway, Mr. L., Ipswich.
Calvert, Mr. R., Market Cross, Stokesley, Yorks.
Campbell, Mr. G. W., Commercial Square, Leyburn.

Campbell, Mr. J., 127, Main Street, Glasgow.
Canning, Mr. W., Great Hampton Street, Birmingham.
Cardwell, Mr. E., Market Street, Lancaster.
Cardwell, Mr. E. (Mr. Lang, Kirkdale, Sydenham, S.E.)
Cardwell, Mr. J., Wakefield.
Carlton, Mr. W. P., 8, High Street, Horncastle.
Carnegie, Mr. W., 108, Patrick Street, Cork.
Carr, Mr. W., 170, Wharf Street, Leicester.
Carr, Mr. W. G., High Street, Berwick-on-Tweed.
Carran, Mr. T., Peel, Isle of Man.
Carruthers, Mr. R. B., 16, Bradshaw St., Moss Lane East, Manchester.
Carteighe, M., F.C.S., 172, New Bond Street, W.
Carter, Mr. W., 2, Union Terrace, Cheetham Hill, Manchester.
Cartwright, Mr. W., Ironmarket, Newcastle-under-Lyne.
Cassels, Mr. T., Bloomgate, Lanark, N.B.
Caunt, Mr. W. F., Penny's Lane, Northwich.
Caw, Mr. J., Cupar, Fife, N.B.
Cawdell, Mr. G., 12, London Street, Hyde Park, W.
Challice, Mr. W. G. W., 34, Villiers Street, Strand, W.C.
Challinor, Mr. M., 25, Market Street, Bolton.
Challinor, Mr. S. M., 35, Deansgate, Bolton.
Chamberlain, Mr. W., Downton, near Salisbury, Wilts.
Chambers, Mr. J., Eastwood, Notts.
Chaplin, Mr. J. L., Cornmarket, Wakefield, Yorks.
Chapman, Mr. H., Marine House, Clevedon.
Chapman, Mr. R. J., Chipping Ongar, Essex.
Charity, Mr. W., 50, Lime Street, E.C.
Chater, Mr. E. M., 129, High Street, Watford.
Cheese, Mr. H., Coleford, Gloucestershire.
Chellew, Mr. W. D., 79, Lord Street, Liverpool.
Chessall, Mr. R., Fore Street, Sidmouth.
Cheverton, G., F.C.S., The Broadway, Tunbridge Wells.
Chifney, G. J., F.C.S., High Street, Mildenhall, Suffolk.
Chignell, Mr. A., Havant, Hants.
Chipperfield, Mr. R., 50, Oxford Street, Southampton.
Chrispin, W., F.C.S., Villa Place, Thirsk, Yorkshire.
Church, Prof. A. H., M.A., F.C.S., The Laboratory, Royal Agricultural College, Cirencester.
Church, Mr. H. J., Cambridge.
Church, Mr. J., 193, Brixton Road, S.W.
Churchill, Mr. H., 1, High Street, Lower Norwood, S.E.
Churchouse, Mr. W. B., Medical Hall, Chard.
Clapham, Mr. J., Wade Lane, Leeds.
Clapham, Mr. J. W., junr., Oak House, Meamwood Road, Leeds.
Clapp, Mr. E. F., 35, Church Street, Stoke Newington, N.
Clarabut, Mr. J. B., 170, Lower Street, Deal.
Clark, Mr. E., Market Street, Lancaster.
Clark, Mr. J., Melbourne Terrace, York.
Clark, Mr. J., Portsoy, Banffshire, N.B.
Clark, Mr. J. A., 11, Duncan Place, London Fields, Hackney, E.
Clark, Mr. J. W., Belvoir Street, Leicester.
Clark, Mr. R. J., 77, Old Town Street, Plymouth.
Clark, Mr. S. P., Cambusland, N.B.
Clark, Mr. W. G., 14, Commercial Street, Leeds.
Clarke, Mr. A. H., Crown Hill, Croydon.
Clarke, Mr. G. B., 3, High Street, Woburn.
Clarke, Mr. I., 45, Blanket Row, Hull.
Clarke, Mr. J. A., 132, London Street, Glasgow.
Clarke, Mr. J. T., 20, Great Clowes Street, Lower Broughton.
Clarke, Mr. R. F., 11, Strand, Torquay.

Clarke, Mr. T., 19, Market Place, Stockport.
Clarke, Mr. T. M., 50, George Street, Richmond, Surrey.
Clarke, Mr. W., 153, High Street, Stockton-on-Tees.
Claypole, Mr. A. H., York Town, Farnborough Station, Surrey.
Clayton, Mr. F. C., 18, Wheeleys Lane, Birmingham.
Clayton, Mr. W., 41, Wicker, Sheffield.
Cleave, Mr. W., Chudleigh.
Cleaver, E. L., F.C.S., 1, Devonshire Ter., Marloes Road, Kensington, W.
Clews, Mr. E. J., 35, Darlington Street, Wolverhampton.
Clifford, Mr. T. A., 3, Kildare Terrace, Westbourne Park, W.
Clift, Mr. E., Lee Bridge, Lewisham, S.E.
Clift, Mr. H., 25, Chilworth Street, W.
Clift, Mr. J., Dorking.
Clifton, Mr. F., 34, Corn Market, Derby.
Clifton, Mr. G. F., 45, Fleet Street, Bury, Lancs.
Clough, Mr. J., 11, High Street, Northwich.
Coates, Mr. A., King Street, Bakewell.
Coates, Mr. J. M., 53, Clayton Street East, Newcastle-on-Tyne.
Cocher, Mr. J., 3, St. James Street, Kings Lynn.
Cocking, Mr. F. J., 10, Wellington Street, Teignmouth.
Cocks, Mr. J. L., 88, Chancery Lane, W.C.
Cocks, Mr. J. W., 1, Madeira Place, Torquay.
Cocksedge, Mr. H. B., 20, Bucklersbury, E.C.
Cockshott, Mr. W., 32, Westgate, Bradford.
Cockton, Mr. J., High Street, Maryport.
Codd, Dr. F., 51, Duke Street, Devonport.
Coker, Mr. O. C., 95, Old Town Street, Plymouth.
Colchester, Mr. W. M., junr., 2, Crown Street, Hoxton, N.
Colclough, Mr. W., 38a, King William Street, London Bridge, E.C.
Coldwell, Mr. D. B., 86, Queen's Road, Peckham, S.E.
Cole, Mr. A. C., Lee, S.E.
Cole, Frederic A., F.C.S., 33, Saint Botolph's Street, Colchester.
Cole, Mr. J., Whittlesey, Cambs.
Coles, Mr. F., 341, Amherst Road, Stoke Newington, N.
Coles, Mr. J. C., Chippenham, Wilts.
Coles, Mr. J. W., 197, Camberwell New Road, S.E.
Coley, Mr. S. J., 57, High Street, Stroud.
Collett, Mr. C. B., 19, South Street, Exeter.
Collier, Mr. J. A., 55, James Street, Bute Dock, Cardiff.
Collins, Mr. H. G. (Mr. Russell's), High Street, Windsor.
Collins, Mr. T. R., 28, London Road, Lowestoft.
Colton, Mr. T., Ousegate, Selby, Yorkshire.
Commans, Mr. R. D., George Street, Bath.
Congreve, Mr. G. T., Rye Lane, Peckham, Surrey.
Constance, Mr. E., 114, Leadenhall Street, E.C.
Cook, Dr. E. A., F.C.S., Crosfield, Barrow & Co., 323, Vauxhall Road, Liverpool.
Cook, R., Esplanade, Ealing, W.
Cook, Mr. R., 28, Market Place, Great Grimsby, Lincolnshire.
Cook, Mr. T., 52, Northgate Street, Gloucester.
Cooke, Mr. J., Waterview, Blackrock, Cork.
Cooke, Mr. P., Church Row, Wandsworth, S.W.
Cooke, Mr. W., 27, St. Giles Street, Norwich.
Cooke, Mr. W. K., 80, Argyle Street, Birkenhead.
Cooper, Mr. Albert, 80, Gloucester Road, South Kensington, S.W.
Cooper, Mr. A., 45, Market Street, Ashby-de-la-Zouch.
Cooper, Mr. F. R., 7, Exchange Street, Manchester.
Cooper, Mr. G., 101, Fore Street, Exeter.
Cooper, Mr. H., 20, Moor Street, Soho Square, W.C.
Cooper, Mr. H. G., 24, High Street, Grantham.

Cooper, Mr. J. N., Bromwich Grange, St. John's, Worcester.
Cooper, Mr. M., Church, near Accrington.
Cooper, Mr. T., 44, Market Place, Leicester.
Cooper, Mr. T., 30, Walmgate, York.
Cooper, Mr. W. J., 17, Market Place, Cockermouth.
Corder, Mr. O., 31, London Street, Norwich.
Corfield, Mr. C., Church Street, St. Day, Cornwall.
Corfield, Mr. T. J. T., Church Street, St. Day, Cornwall.
Cornelius, Mr. J., 11, Regent Place, Teignmouth.
Cornell, Mr. W., 14, Tavern Street, Ipswich.
Cornish, Mr. H. R., 24, Market Place, Penzance.
Cornish, Mr. W., 174, Western Road, Brighton.
Cortis, Mr. C., 12, South Street, Worthing, Sussex.
Cossey, Mr. J., St. John's, Maddermarket, Norwich.
Cosway, Mr. E. C., 19, Notting-Hill Terrace, W.
Cotterell, Mr. W. H., 181, Snargate Street, Dover.
Cotton, Mr. J., Church Street, St. Helen's, Lancs.
Cottrill, Mr. G. J., Shepton Mallet.
Cottrill, Mr. J. W., 24, Park Terrace, Regent's Park, N.W.
Coulter, Mr. G., Sedbergh, near Kendal.
Count, Mr. S., Market Place, Beccles.
Coupland, Mr. J., High Harrogate.
Courtenay, Mr. A., 5, Llanberis Terrace, Rye Croft Road, Lewisham, S.E.
Coutts, Mr. A., Path-head, Kirkcaldy, N.B.
Coverley, Mr. E. C., 4, Thayer Street, W.
Cowan, Prof., M.D., 159, Bath Street, Glasgow.
Cowan, W. M., F.C.S., 29, Cathcart Street, Greenock.
Cowgill, Mr. B. B., Sowerby Bridge, Yorks.
Coxon, Mr. R. J. (Mr. Robinson's), Chester-le-Street.
Cracknell, Mr. C., 217, Edgware Road, W.
Cragg, Mr. J., 52, Fenton Street, Leeds.
Craig, Mr. G., Duncanstone, Insch, Aberdeenshire.
Crampton, Mr. J., Post Office, Sawston, Cambridge.
Crarar, Mr. J., 7, High Street, Blairgowrie.
Crawley, Mr. H., 19, Phœnix Street, Somers Town, N.W.
Crawshaw, Mr. E., 15, Charterhouse Street, E.C.
Cridland, Mr. E., Stradbroke, Suffolk.
Crisp, Mr. F. A., 270, Walworth Road, S.E.
Crispe, Mr. J., 4, Cheapside, E.C.
Cromwell, Mr. O., Brixton Rise, S.W.
Cronshaw, Mr. C., 20, Market Street, Over Darwen.
Crook, Mr. C., East Thorpe, Mirfield, Yorks.
Cross, Mr. C., Winterton, Lincolnshire.
Cross, Mr. W. G., junr., Mardol, Shrewsbury.
Crow, Mr. E. L., Lee Bridge, Lewisham, S.E.
Croyden, Mr. C., 45, Wigmore Street, W.
Crozier, Mr. R., Clifton Square, Lytham.
Crozier, Mr. W., 5, Grainger Street, Newcastle-on-Tyne.
Cruickshank, Mr. J., 20, Shore, Macduff, N.B.
Cruse, Mr. T. H., Palmerston Road, Southsea.
Cryer, Mr. H., 2, Westbourne Grove, Bayswater, W.
Cubley, Mr. G. A., 4, High Street, Sheffield.
Cuff, Mr. R. C., 25, College Green, Bristol.
Cullen, Mr. R. H., 96, Westbourne Grove, Bayswater, W.
Cullen, Mr. T., 12, St. James's Place, Paisley.
Cunliffe, Mr. N., 41, Crook Street, Bolton.
Cupiss, Mr. F., Diss.
Currie, Mr. J., 70, Eglinton Street, Glasgow.
Currie, Mr. J., 479, Sauchiehall Street, Glasgow.

Curtis, Mr. H., 178, High Street, Lewes.
Cutcliffe, Mr. G. J., 7, Strand, Dawlish.
Cutforth, Mr. J. D., 9, Brushfield Street, Bishopsgate Street, E.C.
Cuthbert, Mr. J. M., Bedford.
Cuthbert, Mr. R., 27, Westgate, Huddersfield.
Cutting, Mr. J., 33, Bath Street, Leamington.
Cutting, Mr. T. J., Finkle Street, Selby.

Dadford, Mr. T., 33, Gold Street, Northampton.
Dadley, Mr. E., 21, Carter Gate, Nottingham.
Dale, Mr. J., Cornbrook Chemical Works, Manchester.
Dale, Mr. J., 353, Park Road, Liverpool.
Dale, Mr. S., 144, High Street, Woolwich, S.E.
Dalwood, Mr. J. H., Cheap Street, Sherborne, Dorset.
Daniel, Mr. A., Oldmeldrum, Aberdeenshire, N.B.
Daniel, Mr. S., 30, Harbour Street, Ramsgate.
Daniel, Mr. W. L., 64, High Street, Merthyr.
Darby, S., F.C.S., 140, Leadenhall Street, E.C.
Darling, Mr. W. H., 126, Oxford Street, Manchester.
Darroll, Mr. W., Clun, Salop.
Darwin, Mr. G. H., Bedford Row, Birkenhead.
D'Aubney, Mr. T., 82, Shepherdess Walk, Hoxton, N.
Davenport, Mr. H., 33, Great Russell Street, W.C.
Davenport, Mr. J. T., 33, Great Russell Street, W.C.
David, Mr. J., 75, Oxford Street, Swansea.
David, Mr. S. S., Langharne, St. Clears.
Davidson, Mr. C., 205, Union Street, Aberdeen, N.B.
Davidson, Mr. F., 20, Castle Place, Belfast.
Davies, Mr. D. J., 8, Great Darkgate Street, Aberystwith.
Davies, E., F.C.S., Royal Institution, Liverpool.
Davies, Mr. J. H., Terrace Road, Aberystwith.
Davies, Mr. J. L., Hay, Breconshire.
Davies, Mr. M. P., Tenby.
Davies, R. H., F.C.S., 280, Goldhawk Road, W.
Davies, Mr. T., 2, Albert Bridge, Manchester.
Davis, Mr. D. F., 2, High Street, Leominster.
Davis, Mr. H., 19, Warwick Street, Leamington.
Davis, R. H., F.C.S., High Harrogate.
Davison, Mr. T., 126, Buchanan Street, Glasgow.
Davy, Mr. H., 20, High Street, Rotherham.
Dawe, Mr. J., Lower Street, Callington, Cornwall.
Dawson, Mr. J., 55, High Street, Dudley.
Dawson, Mr. O. R., Belle Vue Road, Southampton.
Day, Mr. J., 116, Briggate, Leeds.
Daykin, Mr. K., Church Street, Ripley, Derbyshire.
Days, Mr. F., 6, Fleet Street, Dublin.
Dean, Mr. S., 320, Roman Road, Bow, E.
Deane, Mr. J., 17, The Pavement, Clapham Common, S.W.
Deck, A., F.C.S., 9, King's Parade, Cambridge.
Deering, Mr. A., 53, Meadow Road, Fentiman Road, Clapham, S.W.
Delves, Mr. G., 187, High Street, Exeter.
De Nance, Mr. W. C., 164, Dumbarton Road, Glasgow.
Dennis, Mr. J. L., Alfreton Road, Nottingham.
Dennison, Mr. M., 222, High Street, Dudley.
Dewson, Mr. S., 90, New Street, Birmingham.
Dickie, Mr. J., 19, Struan Terrace, Victoria Road, Glasgow.
Dickins, Mr. J., 2, Commercial Buildings, Bridlington Quay.
Dinnis, Mr. J., 20, West-Hill Road, Brighton.
Ditchburn, Mr. P., Crook.
Diver, Mr. B., Isleham, Cambridgeshire.

Dixon, Mr. H., Owersby Moor, Market Rasen.
Dixon, Mr. J., 30, Whitefriargate, Hull.
Dixon, Mr. J., 84, Crosby Street, Maryport.
Dixon, J. B., M.D., LL.D., D.D.S., Grove Street, South Hackney, E.
Dobbie, Mr. J., 18, New Bridge Street, Ayr, N.B.
Dobinson, Mr. T., Bishop Auckland.
Dobson, Mr. J., 2, Side, Newcastle-on-Tyne.
Dodd, Mr. W., 169, Southampton Street, Camberwell, S.E.
Dodds, Mr. G. F., Medical Hall, Kelso, Roxburghshire, N.B.
Dodwell, Mr. J., 178, Camberwell New Road, S.E.
Donston, Mr. W., High Cross, Tottenham.
Dott, Mr. D. B., 24, Castle Street, Edinburgh.
Doughty, Mr. M., 26, Blackfriars Road, S.E.
Dove, Mr. J., Sherburn, near South Milford, Yorkshire.
Dowling, Mr. R., 24, King Street, Reading.
Dowman, Mr. G., 160, High Street, Southampton.
Downie, Mr. H., 43, Sandhill, Newcastle-on-Tyne.
Downing, Mr. J. G., 55, High Street, Braintree.
Downward, Mr. J., Market Street, Ulverston.
Dowson, Mr. J., 59, High Street, Redcar.
Drake, Mr. W., Wyke, near Bradford.
Drane, Mr. W., 6, Upper Richmond Road, Putney, S.E.
Draper, H. N., F.C.S., 23, Mary Street, Dublin.
Dresser, Mr. R., 13, Pavement, York.
Driver, Mr. A., 52, Royal York Crescent, Clifton, Bristol.
Driver, Mr. T., Woolton, Liverpool.
Druce, Mr. G. C., 6, The Drapery, Northampton.
Drury, Mr. G. S., 158, Parrock Street, Gravesend.
Duck, Mr. W. B., Hazeldean House, Saltburn-by-the-Sea.
Dudden, Mr. R. M., Sutton Wick, Pensford, Bristol.
Duncalf, Mr. J. M., 7, Exchange Street, Manchester.
Duncan, Mr. S., 17, West Blackhall Street, Greenock, N.B.
Duncan, Mr. W., 13, East Princes Street, Rothesay, N.B.
Duncanson, Mr. W., 38, Port Street, Stirling.
Dunkley, Mr. E., High Street, Tunbridge Wells.
Dunmore, Mr. G. H., 81, Malden Road, N.W.
Dunn, Mr. H., 39, Otley Road, Shipley, Leeds.
Dunn, Mr. J., 360, Scotswood Road, Newcastle-on-Tyne.
Dunn, Mr. S., Fore Street, St. Austell.
Durden, Mr. H., 13, Cornhill, Dorchester, Dorset.
Durrant, Mr. G. R., Old Cross, Hertford.
Dutchman, Mr. W., 44, Seven Sisters Road, N.
Dutton, Mr. F., 15, Town Hall Square, Bolton.
Dutton, Mr. J., Rock Ferry, Birkenhead.
Dyer, Mr. H., Market Place, Trowbridge.
Dyer, Mr. W., Corn Market, Halifax.
Dyson, Mr. W. B., 21, Gloucester Road, South Kensington, W.

Earee, Mr. T., High Street, Staines.
Earland, Mr. W., Bexley, S.E.
Earle, Mr. F., 22, Market Place, Hull.
Earp, Mr. J., High Street, Melbourne, Derby.
Ebdell, Mr. T., Vicar Lane, Leeds.
Edgeler, Mr. W. B., High Street, Petersfield, Hants.
Edisbury, Mr. J. F., Wrexham.
Edwards, Mr. E., 4, Portland Place North, Lower Clapton, E.
Edwards, Mr. G., Stockport Road, Manchester.
Edwards, Mr. J., Lewes Road, Brighton.
Edwards, Mr. J., 1, High Street, Conway.
Edwards, Mr. R. S., Redruth.

Ekin, C., F.C.S., 8, Argyle Street, Bath.
Eldridge, Mr. J. H., Earlham Road, Norwich.
Elias, Mr. J. R., Pentraeth, Anglesey.
Ellinor, Mr. G., Wicker Pharmacy, Spital Hill, Sheffield.
Eliott, Mr. S., junr., 1, Eton Place, Plymouth.
Elliott, Mr. J. D., 3, Orchard Place, Woolwich Road, Greenwich, S.E.
Elliott, Mr. R., 279, High Street, Gateshead.
Ellis, Mr. T. W., Loddon, Norfolk.
Ellison, Mr. J. B., Wombwell, near Barnsley.
Else, Mr. W., 52, King's Road, Brighton.
Emerson, Mr. C., 8, Church Street, West Hartlepool.
England, Mr. W., Fern Villa, 32, Ffynonau Terrace, Swansea.
Ereaut, Mr. G., 12, Bath Street, Jersey.
Esplin, Mr. A., 7, Cowgate, Dundee.
Estcourt, C., F.C.S., Borough Laboratory, 8, St. James's Square, Manchester.
Ettles, Mr. J., 22, London Road, Brighton.
Evans, Mr. A. E., Beaufort Street, Brynmawr.
Evans, Mr. B., Victoria Street, Derby.
Evans, Mr. D. O., Medical Hall, Farnworth, Bolton.
Evans, Mr. E., 11, High Street, Cardigan.
Evans, Mr. E., Aberavon, Port Talbot.
Evans, Mr. E., 56, Hanover Street, Liverpool.
Evans, Mr. E., junr., 56, Hanover Street, Liverpool.
Evans, Mr. E. P., Cleobury Mortimer.
Evans, H. S., F.C.S., 60, Bartholomew Close, London, E.C.
Evans, Mr. I. H., Medical Hall, Market Cross, Lymm.
Evans, J., M.D., 49, Dawson Street, Dublin.
Evans, Mr. J. J., 56, Hanover Street, Liverpool.
Evans, Mr. J. J. O., 1, Victoria Road, Teignmouth.
Evans, Mr. J. R., 56, Hanover Street, Liverpool.
Evans, Mr. R., 116, West Derby Road, Liverpool.
Ewing, Mr. J. L., 139, Princes Street, Edinburgh.
Exley, Mr. G., 48, Hunslet Lane, Leeds.
Eyre, Mr. J. S., High Street, Launceston, Cornwall.
Eyre, Mr. S., 202, Infirmary Road, Sheffield.

Fairburn, Mr. J., Northallerton.
Fairgrieve, Mr. T., Clerk Street, Edinburgh.
Fairlie, Mr. J. E., 569, Gallowgate, Glasgow.
Fairlie, Mr. J. M., 17, St. George's Road, Glasgow.
Fardon, Mr. H., 78, Castle Street, Bristol.
Farie, Mr. G., Bridge of Allan, Stirlingshire.
Farnsworth, Mr. T., Codnor.
Farnworth, Mr. W., 49, King William Street, Blackburn.
Farr, Mr. J., Crown Street, Halifax.
Farrage, Mr. R., Rothbury, Morpeth.
Farrer, Mr. F., High Street, Wrentham, Suffolk.
Farrett, Mr. W. B., 1, Pier Terrace, South Lowestoft.
Farries, T., F.C.S., 16, Coleman Street, E.C.
Farrow, Mr. C. H., 2, Upper Street, Islington.
Farthing, Mr. T., 11, High Street, Spennymoor.
Faulkner, Mr. H., 80, Commercial Road, Newport, Monmouthshire.
Faulkner, Mr. J. R., 33, Ladbroke Grove Road, W.
Faull, Mr. E., Beeston, Notts.
Faull, Mr. J., Westgate, Bradford, Yorks.
Fawcett, Mr. J., New Ferry, Birkenhead.
Fawthorp, Mr. J., Micklefield Terrace, Rawden, near Leeds.
Fenn, Mr. J. W. T., 6, Harwood Terrace, King's Road, Fulham, S.W.

Fennings, Mr. A., West Cowes, Isle of Wight.
Fentiman, Mr. A., 2, Upper East Smithfield, Tower Hill, E.C.
Fenwick, Mr. J., 17, Bute Terrace, Queen's Park, Glasgow.
Ferguson, Mr. J., 6, Strand Street, Liverpool.
Ferguson, Mr. W. K., 53, Great George Street, Leeds.
Ferneley, Mr. C., 61, Tything, Worcester.
Fewtrell, W. T., F.C.S., 41, Gower Place, Euston Square, W.C.
Field, Mr. A. W., 3, Victoria Buildings, Pimlico, S.W.
Field, J. J., F.C.S., North Lodge, New Barnet, Herts.
Field, Mr. W. C., 9, North Street, Taunton.
Fincham, Mr. R., 57, Baker Street, Portman Square, W.
Fingland, Mr. J., Thornhill, Dumfries.
Finlayson, Mr. T., Leith.
Firman, Mr. H. E., 34, West Hill Street, Brighton.
Firth, Mr. W., Barker Street, Oldham.
Fisher, Mr. C., High Street, Ramsgate.
Fisher, Mr. F. D., 1, Market Place, Grantham.
Fisher, Mr. H. A., 35, High Street, Ramsgate.
Fisher, Mr. J. J., 20, Bank Street, Carlisle.
Fisher, Mr. T., 97, Roxburgh Street, Greenock, N.B.
Fitch, R., F.G.S., F.S.A., Norwich.
Fitzgerald, Mr. A. H., 1, Windsor Place, Portobello, N.B.
Fitzhugh, R., F.C.S., Nottingham.
Fleeming, Mr. W., Queen Square, Wolverhampton.
Fletcher, Mr. F. B., Retford, Notts.
Fletcher, Mr. J., 23, King Street, Dudley.
Fletcher, Mr. J., Montpellier Avenue, Cheltenham.
Fletcher, Mr. T., Smallthorne, Stoke-on-Trent.
Fletcher, Mr. T., 1, Church Road, Lytham, Lancs.
Flint, Mr. J., Ranelagh Place, Liverpool.
Flower, Mr. T. S., Opposite the Pier, Ryde, Isle of Wight.
Floyd, Mr. J., Town Hall, Bury St. Edmunds.
Flux, Mr. W., 3, East India Avenue, E.C.
Ford, Mr. J., High Street, Kirriemuir.
Forrest, Mr. R. W., 130, Cumberland Street, Glasgow.
Forster, Mr. R. H., Castle Street, Dover.
Forth, Mr. W., 397, High Street, Cheltenham.
Fortune, Mr. R., Rodger Street, Anstruther.
Foster, Mr. A., Market Place, Dewsbury.
Foster, Mr. F., 52, King's Road, Brighton.
Foster, Mr. F. H., 2, Bank of England Place, Plymouth.
Foster, Mr. J., Collumpton.
Foster, Mr. J., 82, Corporation Road, Carlisle.
Foster, Mr. J. A., 7, Wheeler Street, Birmingham.
Foster, Mr. M. E., 50, Bishopsgate Within, E.C.
Fothergill, Mr. S., Milnthorpe, Westmoreland.
Foulkes, Mr. W. H., 20, High Street, Rhyl, Flints.
Foulkes, Mr. W. J., Birkenhead.
Fowler, Mr. W. R., 7, Market Place, Boston, Lincs.
Fowlie, Mr. G., Turriff.
Fox, Mr. W., 109, Bethnal Green Road, E.
Fox, Mr. W. A., 27, Leyton Road, Stratford, E.
France, Mr. J., 18, Church Street, Rotherham.
Francis, Mr. G., Market Place, Romsey, Hants.
Francis, Mr. G. B., 5, Coleman Street, E.C.
Francis, G. B., junr., F.C.S., 5, Coleman Street, E.C.
Francis, Mr. R. P., 5, Coleman Street, E.C.
Francis, Mr. W. H., 5, Coleman Street, E.C.
Frank, Mr. J. M., Custom House Buildings, Quay Side, Newcastle-on-Tyne.

Frankland, Prof. E., D.C.L., F.R.S., Royal College of Chemistry, South Kensington Museum, S.W.
Franklin, Mr. A., 60, West Street, Fareham.
Franks, Mr. A., 35, Addington Street, Ramsgate.
Fraser, Mr. A., 50A, Lord Street, Liverpool.
Fraser, Mr. J., 17, High Street, Inverness.
Frazer, Mr. D., 113, Buchanan Street, Glasgow.
Frazer, Dr. W., Harcourt Street, Dublin.
Freeland, Mr. J., Bathgate, N.B.
Freeman, Mr. T. W., Ledbury, Herefordshire.
Freestone, Mr. T. M., Bedminster Parade, Bristol.
Frill, Mr. W. E., 15, Avenham Lane, Preston, Lancs.
Froggatt, Mr. T. W., Eyam, *via* Sheffield.
Froom, Mr. W. H., 75, Aldersgate Street, E.C.
Frost, Mr. G., 7, Corn Market, Derby.
Frost, Mr. W. T., Lee Green, S.E.
Fudgé, Mr. C. W., Shepton Mallet.
Fuller, Mr. T. B., Rampant Horse Street, Norwich.
Furneaux, Mr. W. H., 52, Treville Street, Plymouth.
Furniss, Mr. T., 6, Mount Vernon Road, Liverpool.

Gadd, Mr. H., 97, Fore Street, Exeter.
Gadd, Mr. R., 1, Harleyford Road, Vauxhall, S.E.
Gadd, Mr. W. F., 26, St. George's Place, Hyde Park Corner.
Gain, Mr. W. A., Tuxford, Nottinghamshire.
Gaitskell, Mr. J., Gosforth, *via* Carnforth.
Gale, S., F.C.S., 338, Oxford Street, W.
Galt, Mr. W. D., Thornley, Ferry Hill, Co. Durham.
Galwey, Mr. R. J., 49, Dawson Street, Dublin.
Gamble, Mr. H. A., 4, Edwardes Terrace, Kensington, W.
Gardner, Mr. J., 58, George Street, Edinburgh.
Gardner, Mr. J., 39, Ossington Street, Bayswater, W.
Gardner, Mr. J. R., Royal Naval Hospital, Yarmouth.
Gardner, Mr. T., Queen Street, Morecambe, Lancs.
Gardner, Mr. W., Barnard Castle.
Gare, Mr. J., 25, Newfoundland Street, Bristol.
Gare, Mr. W., Bampton, Devon.
Garland, Mr. J. F., Marshfield, Chippenham, Gloucestershire.
Garner, Mr. J., 119, High Street, Kensington, W.
Garner, Mr. T., 75, Allen Road, Stoke Newington, N.
Garratt, Mr. S., 3, Market Place, Rugby.
Garrett, Mr. J., Newport, Mon.
Garside, Mr. T., 10, Cross Street, Southport.
Gaubert, Mr. S., 81, Grosvenor Street, W.
Gedge, Mr. W. S., 90, St. John Street, Clerkenwell, E.C.
Gee, Mr. G., High Street, Sandbach, Cheshire.
Gee, Mr. S., Castleton, near Manchester.
Geldard, Mr. J., St. Austell.
Gemmell, Mr. H., 47, Princes Street, Ardrossan, Ayrshire, N.B.
George, Mr. H., 68, Broad Street, Worcester.
George, Mr. J. E., Hirwain, near Aberdare.
Gerard, Mr. G. R., Great Bedwin, Wilts.
Gerrard, Mr. A. W., University College Hospital, W.C.
Gething, Mr. W. B., 75, Fleet Street, E.C.
Gibbons, Mr. G., 24, West Street, Weston-super-Mare.
Gibbons, Mr. T. G., 41, Market Street, Manchester.
Gibson, Mr. A., Leven, Fife.
Gibson, Mr. B. W., Barnard Castle, Durham.
Gibson, Mr. F., 1, Preston Street, Fleetwood.
Gibson, Mr. J., 86, Upper Brook Street, Manchester.

Gibson, Mr. J. C., Chapeltown, near Sheffield.
Gibson, Mr. W. H., 107, King's Road, Brighton.
Gilbert, Mr. G., Earl's Shilton, Hinckley.
Gill, Mr. H., Boston Spa, Yorkshire.
Gill, Mr. J., 61, Piccadilly, Manchester.
Gill, Mr. J. W., 57, Broad Street, Pendleton, Manchester.
Gill, Mr. W., 1, West Street, Tavistock.
Gillespie, Mr. J., High Street, Irvine, N.B.
Gillett, Mr. J., 10, Nevill Street, Southport.
Gilling, Mr. J., Saffron Walden, Essex.
Gilmour, Mr. W., 11, Elm Row, Edinburgh.
Ginns, Mr. A. B., Rothwell, Northamptonshire.
Gittoes, Mr. S. J., 54, High Street, Wednesbury.
Glaisyer, Mr. T., 12, North Street, Brighton.
Glassford, J. McL., F.C.S., 8, Adelphi Terrace, Old Ford Road, Victoria Park, S. Hackney, E.
Glazier, Mr. W. H., 20, Boundary Road, St. John's Wood, N.W.
Glencross, Mr. W., Kidwelly, Carmarthenshire.
Glover, G. T., F.C.S., Belfast.
Glover, Mr. H., 51, Spon Street, Coventry.
Godfrey, Mr. F., Bank Street, Newton Abbot.
Goldfinch, Mr. G., Hendon, Middlesex.
Good, Mr. T., 47, Minories, E.C.
Goodliffe, Mr. G., Medical Hall, Folkestone.
Goodwin, Mr. J., Lower Clapton, E.
Goodwin, Mr. J., 6, Merrion Row, Dublin.
Gordelier, Mr. W. G., 39, High Street, Sittingbourne.
Gorrie, Mr. A., West End, High Street, Kirkcaldy, N.B.
Goss, Mr. S., 4, High Street, Barnstaple, Devon.
Gossop, Mr. G. K., 88, Church Street, Great Grimsby.
Gostling, Mr. T. P., Diss.
Gostling, Mr. W. A., Diss.
Goucher, J., F.L.S., 43, High Street, Shrewsbury.
Gould, Mr. J., Red Lion Square, Newcastle-under-Lyne.
Gouldbourn, Mr. W., 14, Pride Hill, Shrewsbury.
Gow, Mr. A., Dudley Street, Wolverhampton.
Gowans, Mr. J., 21, High Street, Perth, N.B.
Grady, Mr. F., Villa Street, Hockley, Birmingham.
Graham, Mr. J., Church Street, Carlisle.
Graham, Mr. W. B., Unthank Ewes, Langholm.
Granger, Mr. E. J., Upper Clapton, E.
Grant, Mr. W., High Street, Blairgowrie.
Gray, Mr. C., 12, Church Street, Bilston, Staffordshire.
Gray, Mr. J. T., Crewe.
Greasley, Mr. M. F., 13, North Street, Leeds.
Greaves, Mr. A., Chesterfield.
Greaves, Mr. E., Mexbro', Rotherham.
Greaves, Mr. J., Crewkerne, Somerset.
Greaves, Mr. W. S., Ironville.
Green, Mr. J., 19, Wood Street, Swindon.
Green, Mr. R. P., Witham, Essex.
Green, Mr. S., 2, York Place, Nunhead, S.E.
Greenall, Mr. A., 303, Breck Road, Liverpool.
Greenish, T., F.C.S., 20, New Street, Dorset Square, N.W.
Greenish, Mr. T. E., 20, New Street, Dorset Square, N.W.
Greenwell, Mr. R. H., Chester-le-Street.
Greenwood, Mr. J. F., 22, Market Place, Louth.
Greig, Mr. W., Glassford Street, Glasgow.
Griffin, Mr. A. W., Burnham, Lynn, Norfolk.
Griffin, Mr. T., 3, Woodhill, Northampton.

Griffith, Mr. J. E., Bangor.
Griffith, Mr. R., High Street, Slough.
Griffith, Mr. W. H., 1, Cornhill, Bridgwater.
Griffiths, Mr. E. H., Kidsgrove.
Griffiths, Mr. W., Stamp Office, Aberayron.
Griffiths, Mr. W., 44, Wind Street, Swansea.
Grimwade, Mr. E. W., Mildmay Chambers, 82, Bishopsgate Street. E.C.
Grimwade, Mr. E. W., St. Clements, Ipswich.
Grindley, Mr. W., 6, Northgate Street, Chester.
Grisbrook, Mr. E., Windsor, Berks.
Grisbrook, Mr. S., 51, Wellington Street, Woolwich, S.E.
Grose, Mr. N. M., 5, Castle Street, Swansea.
Groves, Mr. T. B., F.C.S., Weymouth.
Gudgen, Mr. G. B., Kimbolton, St. Neots.
Guest, Mr. E. P., Brentwood, Essex.
Guest, Mr. G. C., 17, St. John's Square, Burslem.
Guest, Mr. W., 13, Carlton Street, Nottingham.
Guilmette, Mr. J. W., Workhouse Hospital, Manchester.
Gulliver, Mr. W., 6, Lower Belgrave Street, Pimlico, S.W.
Gunn, Mr. F. J., Axminster.
Gunn, Mr. W., Market Place, Dunse, N.B.
Gurnell, Mr. W., 34, Union Street, Ryde, Isle of Wight.
Guthrie, Mr. A. D., Bonnington, Edinburgh, N.B.
Guy, Mr. F., 12, North Street, Brighton.
Guyer, Mr. J. B., 11, Strand, Torquay.
Gwatkin, Mr. J. T., 49, Grand Parade, Brighton.

Hackett, Mr. J. H., 70, North Marine Road, Scarborough, Yorks.
Hackman, Mr. L. L., Lake Road, Landport, Hants.
Hadfield, Mr. J., 20, Cheetham Street, Rochdale.
Hadingham, Mr. J. W., 208, High Street, Deptford.
Haffenden, Mr. T., 46, Dyke Road, Brighton.
Haines, Mr. J. J., Market Place, Bromsgrove.
Hake, H. W., Ph.D., F.C.S., 2, Danes Inn, Strand, W.C.
Hall, Mr. F., M.R.C.S., 1, Jermyn Street, S.W.
Hall, Mr. F., 117, Market Place, Stockton-on-Tees.
Hall, Mr. H. R. F., 1, Beverley Road, near Hull.
Hall, Mr. J. T., Medical Hall, Levenshulme.
Hall, Mr. S., 3, Alma Place, Eastbourne.
Hall, Mr. S., Littleborough, near Manchester.
Hall, Mr. T., Breckfield Road North, Liverpool.
Hall, Mr. T., 80, Westgate, Grantham.
Hall, Mr. T. H., 10, Grey Eagle Street, E.
Hall, Mr. W., 102, Blackman Street, S.E.
Hall, Mr. W., Market Street, Lancaster.
Hallaway, Mr. J., 52, Castle Street, Carlisle.
Hallawell, Mr. J., 10, College Lane, Liverpool.
Halley, Mr. A., 2, Cathedral Street, Glasgow.
Halstead, Mr. H., Bank Street, Rawtenstall, Lancs.
Hambly, Mr. C. J., 9, Sydney Terrace, Taunton.
Hambrook, Mr. J. B., 6, Stroud Street, Dover.
Hamilton, J. T., M.D., Sackville Street, Dublin.
Hamilton, J., M.D. (New York), 404, Oxford Street, W.
Hammerton, Mr. E., 28, High Street, Colchester.
Hammond, Mr. C. T., 11, Witham, Hull.
Hamp, Mr. J., Worcester Street, Wolverhampton.
Hampson, Mr. R., 205, St. John-street Road, E.C.
Hanbury, C., F.C.S., Plough Court, Lombard Street, E.C.
Hanbury, Mr. D. B., Clapham Common, S.W.

Hanbury, Mr. F. J., Plough Court, Lombard Street, E.C.
Handford, Mr. E., High Street, Torrington.
Handforth, Mr. E., Lumb Lane, Bradford.
Handley, Mr. C., 41, High Street, Stoke Newington, N.
Hannan, Mr. J. Swinton, near Manchester.
Harburn, Mr. R. H., 71, Market Place, Bishop Auckland.
Harcus, Mr. J., 11, Grey Street, Newcastle-on-Tyne.
Hardcastle, Mr. T. P., 17, Turncroft Lane, Stockport.
Hardeman, Mr. J., 43, Bury New Road, Manchester.
Hardie, Mr. J., 68, High Street, Dundee.
Harding, Mr. J., 4, Market Street, Harwich.
Harding, Mr. J. J., Sudbury, Suffolk.
Hardman, Mr. J. W., 106, Woodhouse Lane, Leeds.
Hardwicke, Mr. E. J., 4, Meat Market, Bury St. Edmunds.
Hardy, Mr. S. C., 177, Regent Street, W.
Hargraves, Mr. H. L., 30, High Street, Oldham.
Hargreaves, Mr. J., 50, Sankey Street, Warrington.
Hargreaves, Mr. M., 108, Fylde Road, Preston, Lancs.
Hargreaves, Mr. R., Clitheroe.
Harley, Mr. J., 3, James's Square, Crieff, N.B.
Harrington, Mr. A., Needham Market, Suffolk.
Harrington, Mr. A., jun., Walsham-le-Willows, Suffolk.
Harrington, Mr. W. (L.A.H.D.), 80, Patrick Street, Cork.
Harris, Mr. E. R., 30, Richmond Place, Brighton.
Harris, Mr. H. W., 208, High Street, Rochester.
Harris, Mr. J., 67, Wellingborough Road, Northampton.
Harris, Mr. M. C. J., West Street, Crewkerne.
Harris, Mr. W. W., High Street, Highgate, N.
Harrison, G., Ph.D., F.C.S., 265, Glossop Road, Sheffield.
Harrison, Mr. J., 7, Central Beach, Blackpool.
Harrison, Mr. J., 33, Bridge Street, Sunderland.
Harrison, Mr. J., Address unknown.
Harrison, Mr. R., Farnworth, near Bolton.
Harrison, Mr. T., Sun Bridge, Bradford, Yorkshire.
Harrison, Mr. W. B., 6, Bridge Street, Sunderland.
Harrower, Mr. P., 136, Coweaddens Street, Glasgow.
Hart, Mr. J., 131, Embden Street, Hulme, Manchester.
Hart, Mr. J., 130, Newport Street, Bolton.
Hart, Mr. T., Bolton New Road, Atherton, near Manchester.
Hart, Mr. W., 99, Higher Bridge Street, Little Bolton.
Hartland, Mr. J., St. Augustine's Parade, Bristol.
Hartshorn, Mr. A. F., Ironbridge, Shropshire.
Hartt, Mr. C., 107, Grafton Street, Dublin.
Harvey, Mr. E., Giltspur Street, E.C.
Harvey, Mr. S., 8, High Street, Canterbury.
Harvey, Mr. W. R., 98, Humberstone Road, Leicester.
Harvie, Mr. G., Princes Street, Helensburgh.
Harvie, Mr. J., 68, Stirling Street, Airdrie, N.B.
Haselden, A. F., F.L.S., 18, Conduit Street, W.
Haslett, Mr. J., 18, North Street, Belfast.
Hasselby, Mr. T. J., 1, Baxtergate, Doncaster, Yorkshire.
Hatch, Mr. R. M., Claremont House, Redland, Bristol.
Hatfield, Mr. G. B., 817, Commercial Road, Limehouse, E.
Havill, Mr. P. W., 15, Fore Street, Tiverton, Devon.
Hawkin, Mr. J., Bedale, Yorks.
Hawkins, Mr. T., 32, Ludgate Hill, E.C.
Hay, Mr. D., Nelson-in-Marsden, Burnley.
Hayes, Mr. J., Great Warley, Essex.
Hayes, Mr. W., 12, Grafton Street, Dublin.
Haydon, Mr. W. F., 23, Burlington Chambers, Birmingham.

Hayhoe, Mr. W., 60, St. George's Road, Pimlico, S.W.
Hayles, Mr. B. H., Esplanade, Ealing, Middlesex.
Haynes, Mr. C. H., 103, Talbot Road, Bayswater, W.
Hayton, Mr. P., High Street, Wigton, Cumberland.
Hayward, Mr. C. J., Lincoln.
Hayward, Mr. W. H., Fore Street, Trowbridge, Wilts.
Heald, Mr. B., Sleaford.
Heap, Mr. E., 149, Junction Road, Upper Holloway, N.
Hearder, Mr. H. P., 24, Westwell Street, Plymouth.
Hearder, Mr. W., 1, Victoria Parade, Torquay.
Heath, Mr. E. A., 114, Ebury Street, S.W.
Heathfield, W. E., F.C.S., F.R.S.E., 8, Wilson Street, Finsbury, E.C.
Heaton, Prof. C. W., F.C.S., Lessness Heath, Kent.
Hebden, Mr. W. C., Northgate, Halifax.
Helmore, Mr. W. H., 15, Old Bond Street, Bath.
Hemingway, Mr. A., 20, Portman Street, W.
Hemingway, Mr. E., 20, Portman Street, W.
Hemingway, Mr. W. 20, Portman Street, W.
Henderson, Mr. C., Wibsey, near Bradford.
Henderson, Mr. M. J., Main Street, Keswick.
Henty, Mr. H. M., 19, High Street, St. John's Wood, N.W.
Herington, Mr. J., Leighton Buzzard, Beds.
Herring, Mr. H., 40, Aldersgate Street, E.C.
Hewitt, Mr. G., 13, Bull Ring, Kidderminster.
Hewlett. Mr. C. J., Cree Church Lane, E.C.
Hey, Mr. D., Hebden Bridge, Yorks.
Heywood, J. S. C., F.C.S., 13, Hanover Terrace, Notting Hill, W.
Hick, Mr. A., High Street, Wath-on-Dearne.
Hick, Mr. J., 3, Broadstones, Bradford.
Hickey, Mr. E. L., 199, King's Road, Chelsea, S.W.
Hickin, Mr. H., Mardol Head, Shrewsbury.
Hickman, Mr. W., Archer Street, Notting Hill, W.
Higgins, Mr. W., 49, Borough, Farnham, Surrey.
Highway, Mr. H., Beaconsfield, Walsall.
Hilder, R. T., M.D., Grove Lodge, Balham, S.W.
Hilditch, Mr. T., 96, Tipping Street, Ardwick, Manchester.
Hill, Mr. A., 14, Oxford Street, South Heigham, Norwich.
Hill, Mr. A. A., Bowlish House, Shepton Mallet.
Hill, Mr. A. B., 101, Southwark Street, S.E.
Hill, Mr. F. (Messrs. Hirst & Co.), Aire Street, Leeds.
Hill, Mr. J., 1, Castle Street, Reading.
Hillidge, Mr. G., 140, Friargate, Preston.
Hillier, Mr. H., 7, Bridge Street, Bath.
Hills, Mr. H. W., 2, Etloe Terrace, Carlisle Road, Leyton, Essex.
Hills, T. H., F.C.S., 338, Oxford Street, W.
Hills, W., F.C.S., 338, Oxford Street, W.
Hinchliffe, Mr. F. G. U., 77, Portland Street, Manchester.
Hind, Mr. T. W. L., Kendal.
Hinds, Mr. H. D., Pontardulais, Carmarthenshire.
Hinds, Mr. J., 127, Gosford Street, Coventry.
Hinds, Mr. W., Coventry.
Hirst, Mr. J., 17, Old Street, Ashton-under-Lyme.
Hiscock, Mr. R., 17, Broadgate, Coventry.
Histed, Mr. E., 2, Upper St. James Street, Brighton.
Hitchcock, Mr. C. E., 108, High Street, Oxford.
Hitchin, Mr. R., 54, St. James' Street, Burnley.
Hitchman, Mr. H., Market Place, Kettering.
Hobbes, Mr. A. E., 1, St. Paul's Street, Milton-next-Sittingbourne.

Hobson, A. S., F.C.S., 3, Upper Heathfield Terrace, Turnham Green, W.
Hobson, Mr. C., Market Place, Beverley.
Hobson, Mr. H., 64, Upper Rushall Street, Walsall.
Hocken, Mr. J., 31, Old Hall Street, Liverpool.
Hodge, Mr. J., 249, Overgate, Dundee.
Hodges, Prof. J. F., M.D., Queen's College, Belfast.
Hodges, Mr. J. F. W., Queen's College, Belfast.
Hodges, Mr. W., Eastgate Row, Chester.
Hodgkinson, Mr. C., 127, Aldersgate Street, E.C.
Hodgkinson, Mr. G., 11, Cross Cheaping, Coventry.
Hodgkinson, Mr. J. S., Matlock Bridge.
Hodgkinson, Mr. W., 127, Aldersgate Street, E.C.
Hodkinson, Mr. J., Mill Street, Macclesfield.
Hodsoll, Mr. T. W. H., 17, Cross Street, Shepherdess Walk, N.
Hogg, Mr. J., 1, Bedford Square, W.C.
Hogg, Mr. R., 9, Albion Place, Hyde Park Square, W.
Holdsworth, Mr. T. W., 32, Steelhouse Lane, Birmingham.
Holford, Mr. T. C., 342, High Street, Stratford, E.
Holliday, Mr. T., Meyrick House, Hill Top, West Bromwich.
Hollier, Mr. E., Market Place, Dudley.
Hollinworth, Mr. W., Birch Vale, near Stockport.
Holmes, Mr. E. M., 17, Bloomsbury Square, W.C.
Holmes, Mr. F. G., Brill.
Holmes, Mr. J., Crown Street, Leeds.
Holmes, Mr. J. T., 30, Upper Baggot Street, Dublin.
Holmes, Mr. T., 349, Blackburn Road, Bolton.
Holmes, Mr. W. M., 338, Oxford Street, W.
Holstead, Mr. T., St. Helen's Road, Daubhill, Bolton.
Holt, Mr. S., 164, West Derby Road, Liverpool.
Hood, Mr. W., M.R.C.S., Castlegate, York.
Hooper, Mr. B., 43, King William Street, E.C.
Hopkin, Mr. W. K., 16, Cross Street, Hatton Garden, E.C.
Hopkinson, Mr. T., Grantham.
Hopton, Mr. E., Idle, Yorks.
Hopwood, Mr. T. S., Richmond, Surrey.
Horncastle, Mr. H., 54, Fargate, Sheffield.
Horncastle, Mr. J., 17, Craven Road, Westbourne Terrace, W.
Horne, Mr. G., 307, Oxford Street, Manchester.
Horner, Mr. E., 20, Bucklersbury, E.C.
Horner, Mr. E., jun., 20, Bucklersbury, E.C.
Horrell, Mr. A. E., 34, High Street, Dartford.
Horsfield, Mr. J. N., Sweet Street, Leeds.
Horsley, J., F.C.S., The Laboratory, Police Station, Cheltenham.
Horsley, Mr. T. W., 274, Portobello Road, Notting Hill, W.
Hothersall, Mr. J., 25, Standishgate, Wigan.
Houghton, Mr. R. W., R. N. Hospital, Haulbowline, near Queenstown.
Houghton, Mr. T., 53, St. Clements, Oxford.
Houghton, Mr. W., 32, Portland Street, Southport.
How, Mr. W., 52, South Street, Dorchester.
Howard, D., F.C.S., Stratford, E.
Howard, J. E., F R.S., Tottenham.
Howard, Mr. W. D., Stratford, E.
Howden, Mr. R., 78, Gracechurch Street, E.C.
Howe, Mr. O. G., Stony Stratford, Bucks.
Howell, Mr. M., 61, High Street, Peckham, S.E.
Howie, Mr. W. L., 8, East London Street, Edinburgh.
Howlett, Mr. H. T., 22, Berkeley Street, Southsea, Portsmouth.
Howlett, Mr. W. H., The Dispensary, Gainsborough.

Howman, Mr. P., Winchcombe.
Howorth, Mr. G. B., Address unknown.
Howorth, Mr. J., Market Place, Doncaster.
Hucklebridge, Mr. J. M., 116, Ebury Street, S.W.
Huggins, Mr. R., 235, Strand, W.C.
Hughes, Mr. E., 14, Market Place, Altrincham, Cheshire.
Hughes, Mr. E., 7, Bridge Street, Llanelly, Carmarthenshire.
Hughes, Mr. E. G., Cateaton Street, Manchester.
Hughes, Mr. F. R., Borrowstowness, N.B.
Hughes, Mr. H., 6, Bridge Street, Bridgnorth.
Hughes, Mr. H. M., Cross Square, St. David's.
Hughes, Mr. J. E., 15, Old Bond Street, Bath.
Hughes, Mr. L. S., 40, Aldersgate Street, E.C.
Hughes, Mr. R., Mona Drug Hall, Llangefni, Anglesey.
Hughes, Mr. S., 154, High Street, Stourbridge.
Hughes, Mr. T., Red House, Llandilo, South Wales.
Hughes, Mr. W., High Street, Presteigne, Radnorshire.
Hugill, Mr. J., 147, Cannon Street, E.C.
Hulley, Mr. J., 99, Manchester Road, Heaton Norris, Stockport.
Humby, Mr. L. W., Market Place, Warminster.
Hume, Mr. A., 61, Northumberland Street, Newcastle-on-Tyne.
Hume, Mr. J. W. D., 16, Worcester Street, Gloucester.
Hume, Mr. R., 102, Cowcaddens Street, Glasgow.
Humpage, Mr. B., Turnham Green, W.
Humphries, Mr. E., Garston, Liverpool.
Humphries, Mr. E., 119, Hammersmith Road, West Kensington, W.
Hunt, Mr. A., Fore Street, Exeter.
Hunt, Mr. C., 29, Chapel Street, Belgrave Square, S.W.
Hunt, Mr. L., 2, Albert Bridge, Manchester.
Hunt, Mr. R., 45, High Street, Winchester.
Hunt, Mr. T., Workhouse, Liverpool.
Hunter, Mr. F. N., 39, Saddler Street, Durham.
Hunter, Mr. G., Withernsea, Yorks.
Hunter, Mr. H., 71, Market Place, Whitehaven, Cumberland.
Hunter, Mr. J. C., 96, Great Western Road, Glasgow.
Hurst, Mr. J., 27, Bottomoth Moor, Oldham.
Hurst, Mr. J. B., Market Place, Louth.
Husband, Mr. J. C., 2, Queen Street, Exeter.
Huskisson, H. O., F.C.S., Swinton Street, Gray's Inn Road, W.C.
Hutchins, Mr. C., Wind Street, Neath.
Hutchinson, Mr. J., 6, Spring Gardens, Buxton, Derbyshire.
Hyne, Mr. H., 132, Seymour Place, Bryanston Square, W.

Iberson, Mr. J., 6, Sheffield Road, Barnsley.
Iliffe, Mr. T. P., 29, Market Place, Nuneaton.
Illingworth, Mr. W. H., 7, High Grove, Southowram, near Halifax.
Imrie, Mr. D., 48, Front Street, Consett, Durham.
Ince, J., F.L.S., F.C.S., F.R.M.S., 29, St. Stephen's Rd., Shepherd's Bush.
Ingall, Mr. J., Ashford, Kent.
Ingham, Mr. J., Upper Tooting, S.W.
Inglis, Mr. H., 211, Every Street, Manchester.
Iredale, Mr. G., 171, York Street, Leeds.
Iredale, Mr. T., 129, North Street, Leeds.
Irish, Mr. T. C., Southgate, Middlesex.
Ismay, Mr. J. G., Groat Market, Newcastle-on-Tyne.
Ive, Mr. W., 115, Gloucester Road, South Kensington, W.
Izod, Mr. J., Church Road, Upper Norwood, S.E.

Jaap, Mr. J., 268, Buchanan Street, Glasgow.
Jackson, Mr. A. H., 43, Gt. Ducie Street, Strangeways, Manchester.

Jackson, Mr. C., Church Road, Acton, W.
Jackson, Mr. G., 759, Rochdale Road, Harpurhey, Manchester.
Jackson, Mr. J., 16, Talbot Road, Blackpool, Lancs.
Jackson, Mr. J., Messrs. Harrison, Parkinson & Co., Bradford.
Jackson, Mr. J. H., Finkle Street, Stockton-on-Tees.
Jackson, Mr. J. T., Westwood, Oldham.
Jackson, Mr. R., 2, Clegg Street, Oldham.
Jackson, Mr. R., 52, Bridlesmith Gate, Nottingham.
Jackson, Mr. W., Crediton, Devon.
Jackson, Mr. W., 43, Glover Street, Leeds.
James, Mr. J. T., 15, Princes Street, Hanover Square, W.
Jarmain, Mr. G., Huddersfield.
Jefferson, Mr. P., 145, Meadow Lane, Leeds.
Jefferson, Mr. T., Church Street, Lower Edmonton, N.
Jeffrey, Mr. T. A., Pittsville, Cheltenham.
Jeffries, Mr. H., 23, High Street, Guildford.
Jenkins, Mr. J. T., Denman Street, New Radford, Nottingham.
Jennings, F. M., F.C.S., Brown Street, Cork.
Jennings, Mr. T. H., 237, Hotwell Road, Bristol.
Jewell, Mr. R. J., 86, New Bond Street, W.
Job, Mr. C. F., Market Place, Wakefield.
Jobson, Mr. R., 125, Scotswood Road, Newcastle-on-Tyne.
John, Mr. D. W., Main Street, Pembroke.
John, Mr. W. D., 7, Maughan Terrace, Penarth, near Cardiff.
Johns, Mr. T. J. R., 8, Cumberland Street, Devonport.
Johnson, Mr. A., 1, Beech Cottage, Moorgate Road, Rotherham.
Johnson, C., F.R.C.S., L.A.C., Castle Park, Lancaster.
Johnson, Mr. F., Prestwich, near Manchester.
Johnson, Mr. J., 8, Brondesbury Terrace, Kilburn, N.W.
Johnson, Mr. J. B., Uttoxeter.
Johnson, Mr. J. H., 7, Church Street, Liverpool.
Johnson, Mr. M., Huyton, Liverpool.
Johnson, Mr. M., Oakenshaw, Clayton-le-Moors.
Johnson, Mr. S. E., Ashby-de-la-Zouch.
Johnson, Mr. T., 80, Wallgate, Wigan.
Johnson, Mr. T. S., 5, Holyrood Terrace, Malvern.
Johnson, Mr. W., 4, Derby Street, Leek, Staffordshire.
Johnstone, Mr. W., Cromarty, N.B.
Jones, Mr. A. M., King Street, Brynmawr, Breconshire.
Jones, Mr. C., 7, Market Square, Hanley.
Jones, Mr. E. B., Lammas Street, Carmarthen.
Jones, Mr. E. P., 52, High Street, Rhyl.
Jones, E. W. T., F.C.S., 10, Victoria Street, Wolverhampton.
Jones, Mr. F., 83, Oxford Street, Liverpool.
Jones, Mr. H., Berwyn Street, Llangollen.
Jones, Mr. H. S., 139, Fulham Road, S.W.
Jones, Mr. J., 60, Chester Road, Hulme, Manchester.
Jones, Mr. J., 27, Station Road, Hadfield.
Jones, Mr. J. A., 74, Hagley Road, Edgbaston, Birmingham.
Jones, Mr. J. H., 9, Finsbury Place North, E.C.
Jones, Mr. J. P., 2, Bridge Street, Aberayron.
Jones, Mr. John, Market Place, Llanrwst.
Jones, Mr. J. T., Bute Road, Bute Town, Cardiff.
Jones, Mr. K. L., Connah's Quay, Flintshire.
Jones, Mr. M., Flint.
Jones, Mr. M. H., Villiers Street, Briton Ferry.
Jones, Mr. R. G., Commercial Place, Lye, Stourbridge.
Jones, Mr. R. T., Bute Street, Treherbert.
Jones, Mr. S. U., Chirton House, Leamington.
Jones, T., F.G.S., F.R.A.S., Brunswick Villas, Shooter's Hill, Kent.

Jones, Mr. T. P., 33, Broad Street, Welchpool.
Jones, Mr. W. C., 23, Bayswater Terrace, Bayswater, W.

Kay, Mr. J., High Street, Crewe.
Kaye, Mr. H., Berry Brow, Huddersfield.
Kearnes, Mr. R. H., Swan Bank, Bilston.
Keen, Mr. B., Totnes, Devon.
Keene, Mr. E., 143, New Bond Street, W.
Keene, Mr. J., Biggenden, Brenchley, Kent.
Kelly, Mr. R., Croscombe House, Wells, Somersetshire.
Kemble, Mr. J., Lostwithiel, Cornwall.
Kemp, Mr. D., 106, High Street, Portobello, Mid-Lothian.
Kemp, Mr. J., Cullen, Banffshire.
Kemp, Mr. J., 11, North Street, Brighton.
Kendall, Mr. F., Bishopton, Stratford-on-Avon.
Kennedy, Mr. W., 59, Trongate, Glasgow.
Kent, Mr. G. F., 134, Broad Street, Pendleton, Manchester.
Ker, Mr. A., 92, Lower Moss Lane, Hulme, Manchester.
Kerfoot, Mr. T., 113, London Road, Manchester.
Kernot, G. C., M.D., 5, Elphinstone Road, Hastings.
Kerr, Mr. C., 56, Nethergate, Dundee.
Kershaw, Mr. J., Neville Street, Southport.
Keyworth, G. A., F.C.S., Harold-Dene, Hastings.
Kimberley, Mr. W., 22, Balsall Street, Birmingham.
Kinch, Mr. C. J., Eaton Hastings, Lechlade.
King, Mr. W., 4, Market Place, Huddersfield.
Kingerlee, Mr. G., Castle Street, Buckingham.
Kingsford, Mr. F., 54, Piccadilly, W.
Kingzett, C. T., F.C.S., Analytical Laboratory, 1, Victoria Street, Westminster, S.W.
Kinninmont, Mr. A., 69, South Portland Street, Glasgow.
Kirk, Mr. S., 89, Upper North Street, Poplar, E.
Kirkbride, Mr. W., 8, Middlegate, Penrith, Cumberland.
Kirkby, Mr. R., Waterson Ground, Outgate, Ambleside.
Kirkup, Mr. T., 65, Elswick Road, Newcastle-on-Tyne.
Kitchin, A., F.C.S., 27, King Street, Whitehaven.
Kite, Mr. W. T., 1, Ormond Villas, Cheltenham.
Knight, Mr. J., 91, City Road, E.C.
Knights, Mr. J. A., Stockton-on-Tees.
Knowles, Mr. C. W., Market Place, Thorne, near Doncaster.
Knowles, Mr. R., Great Crosby, near Liverpool.

Laing, Mr. J. S., 4, Upwood Terrace, Burnt Ash Lane, Lee, S.E.
Laird, Mr. G. H., 40, Queensferry Street, Edinburgh.
Lake, Mr. R., 63, Lupus Street, Pimlico, S.W.
Lakeman, Mr. N., Post Office, Modbury.
Lamb, Mr. T. C., 137, High Street, Chatham.
Lambert, Mr. J., Elvet, Bridge, Durham.
Lambert, Mr. W. H., The Cross, Newtown, Montgomeryshire.
Lamplough, Mr. H., 113, Holborn Hill, W.C.
Lane, Mr. W., 69, Market Street, Manchester.
Langdale, Mr. E. F., 72, Hatton Garden, E.C.
Langford, Mr. J. B., Wellington, Somerset.
Langridge, Mr. T. B., Church Street, Midhurst.
Large, Mr. J. H., 65, New North Road, N.
Lavers, Mr. T. H., Blackheath.
Law, Mr. A., 290, Pentonville Road, King's Cross, W.C.
Lawrance, Mr. E., Welwyn, Herts.
Laws, Mr. J., 111, Church Street, N.W.

Lawson, Mr. E. J., High Street, Whitstable.
Lea, Mr. J., 4, Harbour Street, Folkestone.
Leach, Mr. J., Crawley, Sussex.
Lear, Mr. G. H., 373, Coventry Road, Smallheath, Birmingham.
Leare, Mr. J., Sunbury-on-Thames.
Leath, Mr. J., 5, St. Paul's Churchyard, E.C.
Lee, Mr. J., 9, Kimberley Terrace, Great Yarmouth.
Lee, Mr. S. W., 5, Church Street, Liverpool.
Lee, Mr. W., Castle, Northwich, Cheshire.
Lee, Mr. W., High Street, Honiton, Devon.
Leigh, Mr. J. J., 63, Bondgate, Bishop Auckland.
Leighton, Mr. J. H., 12, Elvet Bridge, Durham.
Lemmon, Mr. R., Hythe, Kent.
Lenfestey, Mr. W. G., 9, Market Street, Faversham.
Lescher, Mr. F. H., 60, Bartholomew Close, E.C.
Lester, Mr. T. R., 107, Patrick Street, Cork.
Le Tall, Mr. F. T., Woodhouse.
Levie, Mr. A. M.
Lewin, Mr. A. C., 7, Whimple Street, Plymouth.
Lewin, Mr. W., 7, Whimple Street, Plymouth.
Lewinton, Mr. A. B., 14, Cleveland Street, Fitzroy Square, W.
Lewis, Mr. J., 2, Nantygwenith Street, Merthyr.
Lewis, Mr. J., 84, High Street, Portsmouth.
Lewis, Mr. R., 3, Taylor Street, Liverpool.
Lewis, Dr. S., 157, Duke Street, Liverpool.
Limon, Mr. H., Burgh-le-Marsh, Lincolnshire.
Lincolne, Mr. N., Ely, Cambridgeshire.
Lindop, Mr. W. J., High Street, Bloxwich, near Walsall.
Lindsay, T., F.C.S., 288, Renfrew Street, Glasgow.
Linford, J. S., F.C.S., 17, Charlton Villas, Charlton, S.E.
Ling, Mr. E., Esher, Surrey.
Linnell, Mr. G., Market Deeping, Lincs.
Linnett, Mr. S. S., Banbury.
Lister, Mr. S., 70, High Street, Great Horton, Bradford.
Little, Mr. H., 82, Seven Sisters' Road, N.
Littlewood, Mr. S., Sutton-in-Ashfield.
Llewellyn, Mr. R., 148, High Street, Merthyr.
Lloyd, Mr. E., jun., Abergele.
Lloyd, Mr. G. H., 30, Church Street, Bilston.
Lloyd, Mr. J., Piccadilly, Hanley.
Lloyd, Mr. J. W., 90, Oxford Street, Swansea.
Lloyd, Mr. J. W., 30, Mount Pleasant, Liverpool.
Lloyd, Mr. T. H., 10, Friar Lane, Leicester.
Loane, Mr. J., 1, Dock Street, Leman Street, E.
Lockhart, Mr. J., Maryhill, near Glasgow.
Lockyer, Mr. G., 208, High Street, Deptford, S.E.
Lockyer, W. J., F.C.S., Pembroke Villa, Elgin Park, Redland, Bristol.
Long, Mr. A. T., Bognor, Sussex.
Long, Mr. H., 2, Western Place, Hove, Brighton.
Long, Mr. H., 48, High Street, Notting Hill, W.
Long, Mr. H., 90, High Street, Croydon.
Longbotham, Mr. J., Chester-le-Street, Durham.
Longley, Mr. J. W., 73, North Street, Leeds.
Longman, Mr. J. H., 24, Methley Street, Kennington, S.E.
Longrigg, Mr. J., Appleby, Westmorland.
Lord, Mr. C., Todmorden, Lancashire.
Lord, Mr. L., Bank Street, Rawtenstall.
Lorimer, Mr. J., North London Chemical Works, Holloway Road, N.
Lowther, Mr. M. K., 70, Osborne Street, Hull.

Luff, A. P., F.C.S., St. Mary's Hospital, W.
Luff, Mr. R., Prospect House, 1, Bute Street, South Kensington.
Luke, Mr. R. S., 30, Tavistock Road, Plymouth.
Lumby, Mr. A., Tranmere, Liverpool.
Lunan, Mr. A., Banchory, N.B.
Lynch, Mr. E. B., 25, Cheetham Street, Rochdale.

Macadam, S., Ph.D., F.R.S.E., F.C.S., Surgeons' Hall, Edinburgh.
MacCreath, Mr. J., 47, Victoria Street, Newton Stewart, Wigtonshire.
Macdonald, Mr. J., 18, West Newington, Edinburgh.
Mace, Mr. J., 3, St. James Street, Bacup.
Macfarlane, Mr. A. Y., 101, Broughton Street, Edinburgh.
Macfarlane, Mr. T. B., 17, Main Street, Wishaw, N.B.
MacGrath, Mr. W. H., Address unknown.
Machattie, A. T., Ph.D., F.C.S., 88, Hope Street, Glasgow.
Machon, Mr. H., Market Place, Saffron Walden.
Macintosh, Mr. A., 21, Montague Street, Rothesay.
Mackay, Mr. G. D., 119, George Street, Edinburgh.
Mackay, J., F.C.S., 119, George Street, Edinburgh.
Mackenzie, Mr. J., 45, Forrest Road, Edinburgh.
Mackey, Mr. J. B., 2, Bouverie Street, E.C.
Mackill, Mr. R. C., Cadrow Street, Hamilton.
Maclagan, D., M.D., F.C.S., 28, Heriot, Row, Edinburgh.
Macpherson, Mr. A., Stornoway.
McClean, Mr. J., 80, Back Lane, Hyde.
McCormick, Mr. F. H., Commercial Road, Hereford.
McCulloch, Mr. F.
McDiarmid, Mr. J. B., 19, Lower Street, Deal.
McDonald, Mr. H. S , 51, London Street, Glasgow.
McDonald, Mr. J., 34, Virginia Street, Glasgow.
M'Donald, Mr. K., Dunkeld.
McGlashan, Mr. D., Fountain Bridge, Edinburgh.
M'Gregor, Mr. A., 47, Eglinton Street, Glasgow.
McGregor, Mr. G., Ellon, Aberdeen.
McKenzie, Mr. W., 17, Great Western Road, Glasgow.
McLean, Mr. K., Loftus, Saltburn-by-the-Sea.
McLeod, Mr. T., 154, Broomielaw, Glasgow.
M'Millan, Mr. J., 17, Great Western Road, Glasgow.
McMurray, Mr. J., 19, George Street, Paisley, N.B.
M'Naught, Mr. A., 4, West Blackhall Street, Greenock.
McNicol, Mr. J., Apothecary Hall, Alva, Stirlingshire.
Macnight, Mr. S. W., 81, High Street, Kirkcaldy.
McVitie, Mr. T., 15, Old Hall Street, Liverpool.
Maggs, Mr. T. C., Yeovil.
Maiden, Mr. W. H., 20, Haymarket Street, Bury, Lancs.
Makins, G. H., F.C.S., Danesfield, Walton-on-Thames.
Maleham, Mr. H. W., 7, West Bar, Sheffield.
Manfield, Mr. W., Kirkgate, Leeds.
Manfull, Mr. H. J., 88, Arkwright Street, Nottingham.
Mangnall, Mr. W., 23, Stricklandgate, Kendal.
Manning, Mr. R. J., Wells.
Manning, Mr. T. D., Yeovil.
Marcham, Mr. J., 2, Lower Bridge Street, Chester.
Marreco, A. F., M.A., F.C.S., College of Physical Science, Newcastle-on-Tyne.
Marriott, Mr. T. E., 143, Walworth Road, S.E.
Marris, Mr. T., 82, Bridge Street, Worksop, Notts.
Marsden, Mr. T. B., Snaith, Yorkshire.
Marsh, Mr. J. H., 6, Milsom Street, Bath.
Marshall, Mr. A., 9, Marlboro' Terrace, Upper Holloway, N.

Marson, Mr. B. B., 174, Park Road, Liverpool.
Marston, Mr. J. T., 105, London Wall, City, E.C.
Martin, Mr. H. G., St. Albans.
Martin, Mr. N. H., 29, Mosley Street, Newcastle-on-Tyne.
Martin, Mr. R., Cross Axes, Deansgate, Bolton, Lancs.
Martin, Mr. T., Cliffe, Lewes.
Martin, Mr. T., 4, Quadrant, Lime Street, Liverpool.
Martindale, W., F.C.S., 10, New Cavendish Street, W.
Mason, Mr. A., 29, Yorkshire Street, Rochdale.
Mason, A. H., F.C.S., 311, Upper Parliament Street, Liverpool.
Mason, Mr. H. C., 29, Woodstock Road, Finsbury Park, N.
Mason, Mr. J. B., 124, Scouringburn, Dundee, N.B.
Mason, Mr. J. W., Cirencester.
Mason, Mr. R. W., 3, Northumberland Terrace, Gunnersbury Station, Chiswick.
Masters, Mr. H. J., Douglas Villas, Bedford.
Mather, Mr. J. H., 11, Grey Street, Newcastle-on-Tyne.
Mather, Mr. W., 84, Corporation Street, Manchester.
Mathews, Mr. J. H., 1, Queen's Gardens, Hyde Park, W.
Mathias, Mr. T., Saundersfoot, Pembrokeshire.
Matthews, Mr. E., High Street, Royston, Herts.
Matthews, Mr. H., 7, Old King Street, Bristol.
Matthews, Mr. W., 12, Wigmore Street, W.
Matthias, Mr. J. J., Weston-super-Mare.
Maunder, Mr. R., 714, Rochdale Road, Manchester.
Maw, Mr. C., 11, Aldersgate Street, E.C.
Maxwell, Mr. G. N., High Street, Biggleswade.
May, Mr. J., Garden Wharf, Battersea, S.W.
Mayfield, Mr. J. T., 10, Normanby Terrace, Gateshead.
Mayger, Mr. W. D., 6, Regent Square, Northampton.
Mayger, Mr. W. J., 6, Regent Square, Northampton.
Mays, Mr. R. J. J., 3, Market Place, South Shields.
Meadows, Mr. H., 15, Westgate Street, Gloucester.
Meadows, Mr. J., 44, Humberstone Gate, Leicester.
Meldrum, Mr. E. D., 22, St. Leonard's Street, Edinburgh.
Mellin, Mr. G., 16, Tichborne Street, Regent Street, W.
Mellin, Mr. J. P., High Street, Wimbledon.
Mellor, Mr. J. G., Market Square, St. Neots, Hunts.
Mells, Mr. H., Kirton, near Boston.
Mercer, Mr. A., Prestwich, Manchester.
Mercer, Mr. G. T., Market Street, Wooler, Northumberland.
Mercer, Mr. J., 121, Adelphi Street, Preston.
Merrell, Mr. J., 1, Queen's Terrace, Camden Road, N.W.
Merrikin. Mr. J., 2, Beaufort Buildings West, Bath.
Merry, Mr. W., Market Place, Ilkeston, near Nottingham.
Merson, Mr. W., The Dispensary, Paignton.
Metcalfe, Mr. A. A., 147, High Street, Great Horton, Bradford.
Metcalfe, Mr. C. L., 13, Whitefriargate, Hull.
Michie, Mr. J., High Street, Forres, Elginshire.
Midgeley, Mr. C., 2, St. Ann's Square, Manchester.
Midgley, Mr. F., 10, Mill Street, Padiham.
Midgley, Mr. J. H., 4, Rue Bank Crescent, Edinburgh.
Miles, Mr. G., Freemantle, near Southampton.
Miller, Mr. C. B., 8, Osborne Place, Blackheath, S.E.
Miller, Mr. T. S., Gray Street, Broughty Ferry, Dundee.
Miller, Mr. W. C., 107, Hockley Hill, Birmingham.
Millidge, Mr. W. H., 47, High Street, Newport, Isle of Wight.
Mills, Mr. J., Eastgate Row, Chester.
Mills, Mr. R. M., Bourne, Lincolnshire.
Milne, Mr. P., 52, Keptie Street, Arbroath, N.B.

Milne, Mr. W., 9, Wellswood Place, Torquay.
Milner, Mr. J. G., 14, Bridge Street, Hull.
Minshull, Mr., 42, Dudley Street, Wolverhampton.
Mitchell, Mr. A., Portree, Isle of Skye, N.B.
Mitchell, Mr. J., 151, Oxford Street, Manchester.
Moinet, F. W., M.D., 13, Alva Street, Edinburgh.
Monkhouse, Mr. H., All Saint's Derby.
Moore, Mr. R., Post Office, Dale Street, Ossett.
Moore, Mr. W. J., 26, King Street, Stirling, N.B.
Moore, Mr. W. V., 15, Princess Square, Plymouth.
Moorhouse, Mr. W., 40, Kirkgate, Wakefield.
Morgan, W., Ph.D., 28, Orange Street, Swansea.
Morgan, Mr. W. J., 5, Holyrood Terrace, Malvern.
Morison, Mr. G., High Street, Peebles, N.B.
Morris, Mr. G. E., 74, Nevill Road, Stoke Newington, N.
Morris, Mr. J. O., 37, Digbeth, Walsall.
Morris, Mr. S. H., 87, Islington, Birmingham.
Morris, Mr. T., 118, Market Street, Farnworth, Bolton.
Morris, Mr. T. H. V., 33, High Town, Hereford.
Morrison, Mr. D., 116, West Bow, Grass Market, Edinburgh.
Morson, T., F.C.S., 124, Southampton Row, W.C.
Mortimer, Mr. J., 1, Mall Place, Clifton, Bristol.
Morton, Mr. J., Ramsbottom.
Morton, Mr. T., 11, Albion Terrace, Kirkintilloch.
Moscrop, Mr. T., 19, Park Hill Place, Bolton.
Moss, J., F.C.S., 300, Holborn, W.C.
Moulden, Mr. W., 49, King William Street, Blackburn.
Moyle, Mr. J., 27, Broadway, Hammersmith, W.
Muir, Mr. G., 98, Cumberland Street, Glasgow.
Muir, M. M. P., F.C.S., Owen's College, Manchester.
Mullock, Mr. R., Charing Cross, Birkenhead.
Mumbray, Mr. H. G., Great Cheetham St., Higher Broughton, Manchester.
Mumbray, Mr. R. G., Richmond, Surrey.
Mumby, Mr. C., 47, High Street, Gosport.
Murdoch, Mr. D., Falkirk, N.B.
Murdoch, Mr. G., 249, Sauchiehall Street, Glasgow.
Murdoch, Mr. J., 34, Virginia Street, Glasgow.
Muskett, Mr. J., Harleston, Norfolk.
Myers, Mr. G., 68, High Street, Hull.

Nairne, Mr. J. S., 11, Winton Terrace, Glasgow.
Napier, Mr. A., 69, South Clerk Street, Edinburgh.
Napier, Mr. G. L., 56, South Street, Exeter.
Nash, Mr. H., 1, Alexandra Road, Kilburn Park, N.W.
Naylor, Mr. W. A. H., 300, Holborn, W.C.
Neale, Mr. H., Riddings, near Alfreton, Derbyshire.
Negus, Mr. S., 55, Gold Street, Northampton.
Nesbit, Mr. J., 162, High Street, Portobello.
New, Mr. W. W., 238, Essex Road, Islington, N.
Newbigin, Mr. J. L., Alnwick.
Newby, Mr. R. J., Castelnau, Barnes, S.W.
Newcome, Mr. J., 70, High Street, Grantham.
Newman, Mr. R., Load Street, Bewdley.
Newman, Mr. W. F., 13, Market Street, Falmouth.
Newport, Mr. W., Foulsham, Norfolk.
Newsholme, Mr. G. T. W., 74, Market Place, Sheffield.
Newsholme, Mr. W., Bradford, Yorkshire.
Newton, Mr. T. A. C., 66, Goldhawk Road, Shepherd's Bush, W.
Nicholls, Mr. T., 99, Wick Road, South Hackney, E.
Nicholson, Mr. A., 11, Pantiles, Tunbridge Wells.

Nicholson, Mr. D. G., Mere Street, Diss.
Nicholson, Mr. H., 38, Argyle Street, Birkenhead.
Nicholson, J. J., F.C.S., High Street, Sunderland.
Nicholson, Mr. W. O., Brigg, Lincolnshire.
Nickson, Mr. J., 56, Broad Street, Ludlow.
Nicol, Mr. J., Partick, Glasgow.
Nicol, Mr. W., Carnoustie, Forfarshire, N.B.
Niven, Mr. W., Morningside, Edinburgh.
Noble, Mr. A., 139, Princes Street, Edinburgh.
Noble, Mr. J., 63, King's Street, South Shields.
Norman, Mr. J. S., Louise Cottage, Costin Street, Bedford.
Nowell, Mr. B., 33, Ladbroke Grove Road, Notting Hill, W.
Nowers, Mr. E. A., Lydd, East Kent.
Nutt, Mr. A. J., 47, Piccadilly, W.

Oakes, Mr. G., 7, Market Street, Chorley.
Oakland, Mr. C., 13, Warser Gate, Nottingham.
Oakland, Mr. W., 46, Alfreton Road, Nottingham.
Ocock, Mr. C., The Bee Hive, High Street, Dulverton.
Odling, Prof. W., M.B., F.R.S., 15, Norham Gardens, Oxford.
Ogilvie, Mr. W. O., 2, West Port, Arbroath.
Oglesby, Mr. J., 31, Micklegate, York.
Oldham, Mr. J., Anlaby Road, Hull.
Oldham, Mr. J., Market Street, Mansfield, Notts.
Oldham, Mr. W., 38, Waterloo Road, Burslem.
Olive, Mr. W. T., Burry Port, South Wales.
Oliver, Mr. J. G., Holsworthy, Devon.
O'Neill, Mr. J., South Bank, Yorks.
Openhan, Mr. G. H., 5, Darwen Street, Blackburn.
Orchard, Mr. E. J., Market Place, Salisbury.
Orme, Mr., Long Street, Atherstone.
Orpe, Mr. T. M., 329, Old Kent Road, S.E.
Owen, Mr. G. B., 21, Broad Street, Park, Sheffield.
Owen, Mr. J., Bishops' Castle, Salop.
Owen, Mr. J., Holloway Road, Islington, N.
Owen, O. D., F.C.S., 12, Worship Street, E.C.
Owen, Mr. S., 2, High Street, Leominster.
Owen, Mr. W., 52, Collingwood Street, Newcastle-on-Tyne.
Oxborrow, Mr. E., 1, Victoria Terrace, Hockley, Birmingham.

Padwick, Mr. J., 5, Preston Street, Brighton.
Padwick, Mr. T., Redhill.
Page, Mr. J., 47, Blackfriars Road, S.E.
Paine, Mr. C., 3, Commercial Street, Newport, Mon.
Paine, Mr. S., 7, Exchange Street, Manchester.
Palethorpe, Mr. S., 53, High Street, Birmingham.
Palmer, Mr. A. N., 69, Market Street, Manchester.
Palmer, Mr. F. W., Ramsey, Hunts.
Palmer, Mr. G. D., 6, Devonshire Terrace, Notting Hill, W.
Palmer, Mr. P. L., East Sheen, Mortlake, Surrey.
Paris, Mr. W., 253, Crown Street, Glasgow.
Park, Mr. W., Grey Street, Broughty Ferry, Dundee.
Parker, Mr. F. C., Ladybank Works, Dundee, N.B.
Parker, Mr. M., 37, Sandhill, Newcastle-on-Tyne.
Parker, Mr. T., 17, Bridge Street, York.
Parker, Mr. W., 254, Manchester Road, Bradford.
Parker, Mr. W. H., 159, Alfreton Road, Nottingham.
Parkes, Mr. J. P., Leyton House, Albion Road, Stoke Newington, N.
Parkin, Mr. C., 47, Market Place, Doncaster.

Parkinson, Mr. R., 1, William Henry Street, Soho, Liverpool.
Parkinson, Dr. R., Bradford, Yorkshire.
Parkinson, Mr. T., 30, Market Place, Great Driffield.
Parkinson, Mr. W., 32, Lees Road, Oldham.
Parr, Mr. S., Long Row, Nottingham.
Pars, Mr. R. C., Thrapstone.
Pasmore, Mr. F. R., 26, Cullum Street, Fenchurch Street, E.C.
Pasmore, Mr. G., 1, Corner of Southernhay, Exeter.
Passmore, Mr. F., 17, Bloomsbury Square, W.C.
Patchett, I., F.C.S., F.R.A.S., Birstall, near Leeds.
Paterson, Mr. A., 6, Camden Place, Plantation, Glasgow.
Paterson, Mr. J., Helmsdale, Sutherlandshire.
Paton, J., F.L.S., Kelvingrove Museum, Glasgow.
Patterson, Mr. D. J., West Hill, Mansfield, Notts.
Pattinson, J., F.C.S., 75, The Side, Newcastle-on-Tyne.
Pattinson, Mr. J. S., 41, Botchergate, Carlisle.
Pattison, Mr. G., 139, St. John Street Road, E.C.
Paul, Dr. B. H., F.C.S., 17, Bloomsbury Square, W.C.
Payne, A., F.C.S., Galen Chemical Works, Ettingshall, near Wolverhampton.
Payne, Mr. J. C. C., Botanic Road, Belfast.
Payne, Mr. J. B., 63, Piccadilly, Manchester.
Payne, Mr. S., Wallingford, Berkshire.
Peake, Mr. A., Queen Street, Earlestown.
Peake, Mr. H., New Bridge, Dover.
Peake, Mr. H. F., Twickenham.
Pearce, Mr. J., Crewkerne.
Pearce, Mr. J. A., Cainscross, Stroud.
Pearce, Mr. T., 134, Westgate Street, Gloucester.
Pearson, Mr. E.
Peatson, Mr. H. R., 102, Broughton Road, Salford, Manchester.
Peck, Mr. F. A., Medical Hall, Sea View Street, Cleethorpes.
Pedler, Mr. G. S., 199, Fleet Street, E.C.
Pedley, Mr. T., Mill Bank, Triangle, near Halifax.
Penketh, Mr. J., address unknown.
Penney, Mr. W., High Street, Poole.
Penney, Mr. W. S., Mostyn Street, Llandudno.
Pennington, Mr. T., 14, Bolton Street, Bury, Lancaster.
Penrose, Mr. A. P., 5, Amwell Street, E.C.
Perfect, Mr. R., Bingley, near Leeds, Yorks.
Perry, Mr. G. E., 77, Hagley Road, Birmingham.
Peters, Mr. J., Shore Street, Gourock.
Peters, Mr. J. F., 4, High Street, Jedburgh, N.B.
Pettinger, Mr. E., 57, High Street, Hampstead, N.W.
Phillips, Mr. J., Church Stretton, Salop.
Phillips, Mr. J., 60, Wallgate, Wigan.
Philp, Mr. J., Wadebridge, Cornwall.
Pick, Mr. R., South Parade, Northallerton.
Pickard, Mr. W., 338, Oxford Street, W.
Picken, Mr. T. W., Newport, Salop.
Pickering, Mr. A., 45, Lowgate, Hull.
Pickering, Mr. J., Market Place, Crowle, Doncaster.
Picnot, Mr. C., 24, High Street, Strood.
Pidd, Mr. A. J., 221, Chester Road, Hulme, Manchester.
Pilley, Mr. S., 9, Bargate, Boston.
Pinkerton Mr. J. S., 248, London Road, Glasgow.
Pinkerton, Mr. W., 17, Greenside Place, Edinburgh.
Pitchford, Mr. W., address unknown.
Pitman, Mr. J., 50, Redcliff Hill, Bristol.
Place, Mr. W. B., Betley, Crewe.

Plant, Mr. G. W., New Edmund Street, Birmingham.
Plant, Mr. W. E., Somerby, near Oakham.
Plowman, Mr. S., No. 2 Residence, St. Thomas's Hospital, S.E.
Plumley, Mr. J. G., The Bridge, Bristol.
Pocklington, Mr. H., Victoria Chambers, South Parade, Leeds.
Poingdestre, Mr. C. R., 187, Newington Butts, S.E.
Pollard, Mr. H. H., 140, High Street, Ryde, Isle of Wight.
Pond, Mr. B. C., New Park Road, Brixton Hill, S.W.
Pond, Mr. G. P., 68, Fleet Street, E.C.
Ponsford, Mr. J., Wolborough Street, Newton Abbot, Devon.
Poole, Mr. J., 50, High Street, Newcastle, Staffs.
Pooley, Mr. J. C., 8, George Street, Bath.
Poore, Mr. E., Broadstairs.
Porter, Mr. J., Coalville, Leicestershire.
Postans, Mr. A. W., 35, Baker Street, W.
Potter, Mr. H., 8, Park Terrace, Sutton, Surrey.
Potts, E., F.C.S., Villiers Street South, Sunderland.
Potts, Mr. J., 59, Church Street, Seaham Harbour, Durham.
Potts, Mr. R. S., Market Place, Ilkeston.
Potts, Mr. T., 5, Grainger Street, Newcastle-on-Tyne.
Powell, Mr. D., St. Thomas, Swansea, Glamorganshire.
Powell, Mr. W., Boar Lane, Leeds.
Powell, Mr. W., Caroline Street, Bridgend.
Power, Mr. E., Walton-on-Thames.
Powers, Mr. E., Priory Works, Coventry.
Pownall, Mr. T. R., 45, St. George's Road, Bolton.
Pratt, Mr. G. W., 49, Cavendish Street, Chorlton-on-Medlock, Manchester.
Pratt, Mr. R. M., Cattle Market, Otley, Yorks.
Preston, Mr. J., 4, High Street, Sheffield.
Preston, Mr. J. C., 88, Leadenhall Street, E.C.
Price, Mr. R., 54, Loftus Road, Shepherds Bush, W.
Price, Mr. T. U., High Street, Arundel.
Prichard, Mr. E., 10, Vigo Street, Regent Street, W.
Pridmore, Mr. W., Castle Street, Hinckley, Leicestershire.
Priestley, Mr. J., 17, Croft Street, Manchester Road, Bradford.
Prince, Mr. A. G., 2, Market Street, Longton, Staffs.
Prince, Mr. H., 5, Fore Street, Taunton.
Pring, R. W., L.A.H.D., 7, Plough Buildings, Belfast.
Prior, Mr. G. T., 32, Broad Street, Oxford.
Pritchard, Mr. J., 67, Chorlton Road, Manchester.
Probyn, Mr. C., 55, Grosvenor Street, Grosvenor Square, W.
Procter, Dr. W., 24, Petergate, York.
Proctor, Mr. A. D., Dufftown, Banffshire.
Proctor, Mr. B. S., 11, Grey Street, Newcastle-on-Tyne.
Proctor, Mr. R., Penarth, Glamorganshire.
Provost, Mr. J. P., High Street, Huntingdon.
Pryer, Mr. W. S., West Street, Axminster.
Pugh, Mr. G., 11, Grenville Square, W.C.
Pugh, Mr. H., Llanegryn, near Towyn, Merionethshire.
Pullan, Mr. T., 174, Lumb Lane, Bradford, Yorkshire.
Pullin, Mr. W. H., York Terrace, Leamington.
Purdue, Mr. T., Witney, Oxon.
Purdy, Mr. J. T., Willington, via Durham.
Purefoy, Richard D., M.B., T.C.D., L.A.H.D., Rotunda Hospital, Dublin.
Purves, Mr. S., 70, Haymarket Terrace, Edinburgh.

Quinlan, F. J. B., M.D., 29, Lower Fitzwilliam Street, Dublin.

Radley, Mr. W. V., 74, Market Place, Sheffield.
Radnall, Mr. W. H., King Street, Ulverston.

Raimes, Mr. R., Bonnington Park, Edinburgh.
Rainford, Mr. J., Castle Fields, Shrewsbury.
Rait, Mr. R. C., 322, Hamilton Place, Partick, Scotland.
Ramsbottom, Mr. G., Waterfoot, near Manchester.
Randall, W. B., F.C.S., 146, High Street, Southampton.
Ransom, Mr. W., Hitchin.
Rastrick, Mr. R. J., King's Road, Southsea, Hants.
Ratcliffe, Mr. W., 4, Larches Lane, Compton Road, Wolverhampton.
Rattray, Mr. W., Links Street, Aberdeen.
Rawlings, Mr. C. J., Market Place, Warminster.
Rayner, Mr. J., Long Row, Nottingham.
Rayson, Mr. A. J., 5, Parade Terrace, South Lowestoft.
Rayson, Mr. H., 3, Mornington Terrace, Wanstead, E.
Read, Mr. J., Salisbury.
Read, Mr. W., Helmsley, Yorks.
Reade, Mr. O. A., Royal Naval Hospital, Plymouth.
Reboul, A. P., D.L.R.C.S., 60, Liverpool Road, N.
Redfern, Mr. T., 50, King Street, Penrith.
Redford, Mr. A., 30, Oxford Street, Liverpool.
Redwood, Prof. T., Ph.D., F.C.S., 17, Bloomsbury Square, W.C.
Rees, Mr. D., Conwill Elvet, near Carmarthen.
Rees, Mr. W. H., Dartmouth.
Reichardt, Mr. E., 11, Great Titchfield Street, Oxford Street, W.
Remmers, Mr. B. H., 63, West Regent Street, Glasgow.
Reynolds, Mr. F., 14, Commercial Street, Leeds.
Reynolds, Mr. J. J., 3, Hanover Street, W.
Reynolds, R., F.C.S., 13, Briggate, Leeds.
Reynolds, Mr. T., Caerphilly, near Cardiff.
Rhind, Mr. W. W., 69, Gloucester Road, Regent's Park, W.
Rhodes, G. W., M.R.C.S., L.S.A. Lond., 1, Queen's Street South, Huddersfield.
Rhodes, Mr. W. H., 74, Manwood Road, Leeds.
Rich, S. W., F.C.S., 23, Lloyd Square, W.C.
Rich, Mr. T., Weston-super-Mare.
Richardson, B. W., M.D., F.R.S., 12, Hinde Street, W.
Richardson, Mr. G., 12, Norland Place, Notting Hill, W.
Richardson, J. G. F., Ph.D., F.C.S., Haughton House, Stoney Gate, Leicester.
Richardson, Mr. T. J., 23, London Road, Carlisle.
Richmond, Mr. R., junr., Leighton Buzzard, Beds.
Rickard, Mr. J. R., Wadebridge, Cornwall.
Ridd, Mr. A. H., 5, Windsor Terrace, Carlton Road, Peckham, S.E.
Riddell, H. B., F.C.S., Whitefield House, Rothbury, Morpeth.
Riddle, Mr. W. R., Market Place, Hexham.
Ridley, Mr. E. H., 223, Oxford Street, Manchester.
Rimmington, F. M., F.C.S., Bradford, Yorkshire.
Ringrose, Mr. G., 123, St. George's Street, E.
Ritson, Mr. T., 4, High Street, Sunderland.
Roach, Mr. P., 8, St. James's Street, S.W.
Robbins, J., F.C.S., 372, Oxford Street, W.
Roberts, Mr. G., High Street, West Bromwich.
Roberts, Mr. J., Middleton, Lancashire.
Roberts, Mr. J. C., Edon Road, Dolgelley, North Wales.
Roberts, Mr. M., High Street, Bangor.
Roberts, Mr. P., St. Asaph.
Roberts, Mr. R. M., Foregate, Chester.
Robertson, Mr. J., 35, George Street, Edinburgh.
Robinson, Mr. A., John Street, West Bromwich.
Robinson, Mr. A. F., 2, Northgate, Darlington.
Robinson, Mr. B., 1, Broad Street, Pendleton, Manchester.

Robinson, Mr. J., Orford Hill, Norwich.
Robinson, Mr. J., Stanley, near Chester-le-Street, Durham.
Robinson, Mr. J., East Terrace, Neasham Road, Darlington.
Robinson, Mr. J. F., Knowsley Buildings, Liverpool.
Robinson, Mr. J. Frodsham-, Frodsham, Cheshire.
Robinson, J. R., LL.D., F.R.G.S., Westgate, Dewsbury.
Robinson, Mr. J. S., 1, Eversfield Place, St. Leonard's, Hastings.
Robinson, Mr. J. S., Alfreton.
Robinson, Mr. R., 58, Yorkshire Street, Rochdale.
Robinson, Mr. R. A., 195, Brompton Road, S.W.
Robinson, Mr. W., Main Street, Cockermouth.
Robson, Mr. J., 26, Scotch Street, Carlisle.
Robson, Mr. J. C., 37, Linthorpe Road, Middlesbro'.
Robson, Mr. T., 4, Victoria Road, Brighton.
Rodger, Mr. J., Inverary, Argyllshire.
Roger, Mr. J. P., Rhynie, Aberdeenshire, N.B.
Rogers, Mr. A. R., Newmarket.
Rogers, Mr. W., 53, Ben Jonson Road, Stepney, E.
Rogerson, Mr. M., Hope Villa, Boston Spa, near Tadcaster, Yorkshire.
Romans, Mr. T. W., High Street, Wrotham, Sevenoaks.
Rookledge, Mr. J., Easingwold.
Roper, Mr. H. E., Oundle.
Rose, Mr. A., Apothecaries' Company, Sauchiehall Street, Glasgow.
Rose, Mr. J. D., 18, Ormonde Street, Jarrow-on-Tyne, Durham.
Ross, L. B., F.C.S., Great Driffield.
Ross, Mr. R., 43, High Street, Old Aberdeen.
Rossiter, Mr. F., 20, George Street, Hastings.
Rossiter, Mr. G., Bampton Street, Tiverton.
Rossiter, Mr. J., Royal Melville Hospital, Chatham.
Rossiter, W., F.R.G.S., F.C.S., 91, Blackfriars Road, S.E.
Roulston, Mr. B. W., 39, Aire Street, Goole.
Rouw, Mr. W. T., Market Place, Ruthin.
Rowe, Mr. P. M., High Street, Marlborough.
Rowe, Mr. R., 2, Cromwell Place, South Kensington, S.W.
Rowe, S. T., M.A., Ph.D., Redruth.
Rowell, Mr. R. H., Houghton-le-Spring.
Rowland, Mr. W., High Street, Wrexham.
Rowlands, Mr. D., Tregaron, S. Wales.
Russell, Mr. C. J. L., Opposite the Castle Hill, Windsor.
Russell, Mr. J., 111, Nethergate, Dundee.
Rust, Mr. J., Thaxted, Essex.
Rutherford, Mr. E., High Street, Tow Law.

Sainsbury, Mr. S., 176, Strand, W.C.
Salisbury, Mr. W. B., 3, Market Street, Leicester.
Salmon, Mr. F. W., 30, Western Road, Hove, Brighton.
Salter, Mr. J. B., Castle Street, Shrewsbury.
Samson, Mr. E., 114, Redcliffe Street, Bristol.
Samuel, Mr. A. H., 145, Upper Parliament Street, Liverpool.
Sanderson, Mr. H., 71, Parade, Birmingham.
Sandford, Mr. G. W., 47, Piccadilly, W.
Sandiland, Mr. R. B., Bicester, Oxfordshire.
Sandy, Mr. F. W., 390, Walworth Road, S.E.
Sanger, Mr. W. A., 252, Oxford Street, W.
Sangster, Mr. A., 66, High Street, St. John's Wood, N.W.
Sapp, Mr. A., Winchester Street, Basingstoke.
Sargent, W. D., M.R.C.S., L.S.A., Albany Road, Camberwell, S.E.
Sarjeant, Mr. J. W., Wellingborough, Northamptonshire.
Sarsfield, Mr. W., 7, Market Place, Durham.
Saunders, Mr. D. P., Haverfordwest.

Saunders, Mr. T. P., Bradford-on-Avon.
Savage, Mr. J. L., 140, Lister Hills Road, Bradford, Yorks.
Savage, Mr. J. W., Fenny Castle, Wells, Somerset.
Savage, Mr. W. D., Park Road East, Brighton.
Savage, Mr. W. W., 65, Edward Street, Brighton.
Saville, Mr. J., 4, Goodramgate, York.
Savory, Mr. A. L., 143, New Bond Street, W.
Savory, Mr. J. F., 143, New Bond Street, W.
Saxby, Mr. H., jun., Lewes, Sussex.
Saxton, Mr. J., 2, St. Peter's Street, Leeds.
Sayer, Mr. E. C., Warrington House, Ipswich.
Schacht, G. F., F.C.S., 7, Regent Street, Clifton, Bristol.
Schacht, Mr. W., 6, Finsbury Place South, E.C.
Schmidt, Mr. A., 382, New City Road, Glasgow.
Schorlemmer, C., F.R.S., Owen's College, Manchester.
Schweitzer, J., F.C.S., 79, Pavilion Road, Sloane Street, S.W.
Scott, Mr. W., 46, Mary Street, Dublin.
Scott, W. L., F.C.S., County Analyst's Laboratories, Wolverhampton.
Seaman, Mr. J. S., Marlow.
Seath, Mr. A., Dunfermline.
Selkirk, Mr. J., 7, Pembroke Street, Cork.
Selleck, Mr. E., Apothecaries' Hall, Blackfrairs, E.C.
Sells, Mr. R. J., Tunbridge Wells.
Semple, Mr. J., Barr's Brae, Port Glasgow.
Senier, Dr. A., F.C.S., 17, Bloomsbury Square, W.C.
Sergeant, Mr. T. W., 61, Ashton Street, Liverpool.
Severs, Mr. J., 23, Stricklandgate, Kendal.
Shapley, Mr. C., 11, Strand, Torquay.
Sharman, W., F.C.S., 247, Mare Street, Hackney.
Sharp, Mr. D. B., Borough Road, Sunderland.
Sharp, Mr. J., 5, Sedgefield Terrace, Bradford, Yorks.
Sharpe, Mr. G. Y., 34, High Street, Notting Hill, W.
Shaw, Mr. A., Riddings, Derbyshire.
Shaw, Mr. C. J., West End, Alford, Lincs.
Shaw, Mr. H. W. (Messrs. Dunhill, Son & Shaw), Doncaster.
Shaw, Mr. J., 24, Great George Place, Liverpool.
Shaw, Mr. R. H., 24, Brighton Street, Seacombe, Birkenhead.
Shelley, Mr. H., 2, Church Street, Twickenham.
Shenstone, W. A., F.C.S., Exeter School, Exeter.
Shephard, Mr. T. F., 46, All Saints' Road, Westbourne Park, W.
Shepheard, Mr. T., 12, Bridge Street Row, Chester.
Shepherd, Mr. J., 144, Huddersfield Road, Oldham.
Sherlock, Mr. T., Market Place, St. Helen's, Lancs.
Shields, Mr. J., Alsager, Stoke-on-Trent.
Shipman, Mr. J. J., 22, Bridge Street, Northampton.
Shirtliff, Mr. W., 66, Goldhawk Road, Shepherd's Bush, W.
Short, Mr. E. C., Post Office, Bushey Heath.
Sidgwick, Mr. G. C., 9, Alexandra Terrace, Sunderland.
Sidley, Mr. T. I., Brunswick Terrace, Stafford.
Siebold, L., F.C.S., 18, Egerton Terrace, Stockport Road, Manchester.
Sillitoe, Mr. F. S., Station Road, Red Hill, Surrey.
Silson, Mr. R. W., 113, Church Street, Manningham, Bradford.
Silverlock, Mr. H. T., 92, Blackfriars Road, S.E.
Silvers, Mr. F. T., 19, Church Street, Camberwell, S.E.
Simmonds, Mr. P. L., 29, Cheapside, E.C.
Simms, Mr. R. J., 3, Ramshill Road, South Cliff, Scarborough.
Simpkins, Mr. J., Minchinhampton.
Simpson, Mr. A., 9, Melbourne Street, Stalybridge.
Simpson, Mr. G., Paikes Street, Alnwick, Northumberland.
Simpson, Mr. H. D., 2, New Street, Louth.

Simpson, Mr. J., South Lambeth Dispensary, Albert Square, Clapham Road, S.W.
Simpson, Mr. R., 16, Henry Street, Dublin.
Simpson, Mr. T., Bloxham, Banbury, Oxon.
Simpson, Mr. T., 6, Havelock Terrace, Forest Hill, S.E.
Sims, Mr. J., Hirwain.
Sims, Mr. W., 24, Lewis Street, Aberaman, Aberdare.
Sinclair, Mr. R., Invergordon, N.B.
Sindall, Mr. J. W., High Street, Knaresborough.
Sirett, Mr. H., Brackley, Northamptonshire.
Skidmore, Mr. J., Chilworth Street, Paddington, W.
Skinner, Mr. M. H., Keelby, near Ulceby, Lincs.
Skinner, Mr. T., 5, Union Square, Hoxton, N.
Skipper, Mr. E., 4, Dalston Lane, E.
Skirrow, Mr. W. E., Bingley, Yorks.
Skirving, Mr. G., 47, Lower High Street, Wednesbury, Staffs.
Skoulding, Mr. G. S. F., Church Plain, Yarmouth.
Skoulding, Mr. W., Wymondham, Norfolk.
Slack, Mr. J. K., Prescott.
Slade, Mr. J., Tenbury.
Slater, Mr. J., 76, Bedford Street, Leicester.
Slater, Mr. J., Sadler Street, Wells, Somerset.
Slater, Mr. T., Stone, Staffordshire.
Slater, Mr. W. H., Romsey, Hants.
Slinger, Mr. F., High Ousegate, York.
Slingsby, Mr. C. S., Bridge Street, Hindley.
Smeeton, Mr. W., 26, Commercial Street, Leeds.
Smiles, Mr. J., 1, Henderson Row, Edinburgh.
Smith, Mr. A. W., 93, High Street, Rye, Sussex.
Smith, Mr. C. S., Cirencester.
Smith, Mr. D., Market Place, Stroud, Gloucestershire.
Smith, E., F.C.S., 8, The Strand, Torquay.
Smith, F. C., M.D., 21, Notting Hill Terrace, W.
Smith, Mr. J., Hillam Farm, Urmston, near Manchester.
Smith, Mr. J., 12, Worship Street, E.C.
Smith, Mr. J. B., Dulwich, S.E.
Smith, Mr. J. De Carle, Magdalen Street, Norwich.
Smith, Mr. J. S., 8, Crowhurst Road, Brixton, S.W.
Smith, Mr. J. S. T. W., Back Street, Hexham.
Smith, Mr. J. T., 12, Down Street, Piccadilly, W.
Smith, Mr. J. W. (Mrs. Haselar's), Stone Street, Cranbrook, Kent.
Smith, Mr. N., 372, High Street, Cheltenham.
Smith, Mr. P. S., 21, Duke Street, Edinburgh.
Smith, R., M.D., Durham County Asylum, Sedgefield, Ferryhill.
Smith, Mr. R. B., Market Place, Norwich.
Smith, Mr. S. A., 102, Parade, Leamington.
Smith, T., F.C.S., Heriot Hill House, Edinburgh.
Smith, Mr. T., Top of Union Street, Ryde, I.W.
Smith, Mr. T. J., F.G.S., F.L.S., 10, North Church Side, Hull.
Smith, Mr. W., 157, Friargate, Preston.
Smith, Mr. W., Market Place, Nottingham.
Smith, Mr. W., 48, Porchester Road, W.
Smith, Mr. W., Sutton Coldfield.
Smith, Mr. W. F., 280, Walworth Road, S.E.
Smith, Mr. W. H., 36, St. George's Road, Brighton.
Smyth, Mr. T., 178, Islington, Liverpool.
Snape, Mr. E., Great Hampton Street, Birmingham.
Snowdon, Mr. R., 52, Robertson Street, Hastings.
Soames, Mr. W., Wargrave, near Henley-on-Thames.
Soole, Mr. J. H., High Street, Grays, Essex.

Souter, J. C., M.D., F.C.S., 88, Junction Road, Highgate, N.W.
Southall, A., F.C.S., Bull Street, Birmingham.
Southall, Mr. W., Bull Street, Birmingham.
Soutter, Mr. J. S., Hedon, Hull.
Spear, Mr. G., 150, Queen Street, Portsea.
Spearing, Mr. J., 53, Above Bar, Southampton.
Speechly, Mr. G., North Street, Bishop Stortford.
Spencer, Mr. J., Undercliffe, Bradford.
Spencer, Mr. T., London House, South Street, Sleaford, Lincs.
Spencer, Mr. W. A. C., 108, Patrick Street, Cork.
Spencer, Mr. W. H., Burnham Market, Norfolk.
Spilsbury, Mr. J., 33, Bath Street, Leamington.
Sprackett, Mr. G., The Drawbridge, Bristol.
Spyer, Mr. N., 29, Chapel Street, Belgrave Square, S.W.
Squire, Mr. A., 1, Bush Lane, E.C.
Squire, Mr. A. H., 277, Oxford Street, W.
Squire, Mr. F. J. C., St. Austell.
Squire, Mr. J., 41, Queen Street, Oxford.
Squire, P., F.L.S., 277, Oxford Street, W.
Squire, Mr. P. W., 277, Oxford Street, W.
Squire, Mr. W., High Street, Hanwell, Middlesex.
Squire, Mr. W., 5, Coleman Street, E.C.
Stable, Mr. R. H., 5, Blackstock Road, Finsbury Park, N.
Stacey, Mr. S. Ll., 300, Holborn, W.C.
Stacy, Mr. F., 4, Woodman Terrace, Westow Hill, Upper Norwood, S.E.
Stainer, Mr. J., 59, Sandgate Road, Folkestone.
Stainer, Mr. R. W., 84. St. James's Road, Southsea, Hants.
Stainthorpe, W. W., M.D., C.M., Wortley, Sheffield.
Stamp, Mr. E. B., 29, High Street, Hampstead, N.W.
Standring, Mr. J., 1, Piccadilly, Manchester.
Stanford, E. C. C., F.C.S., Thornloe, Partick Hill, Glasgow.
Staning, Mr. W., 55, Cogan Street, Hull.
Stanley, Mr. R. S., Southwell, Notts.
Stannard, Mr. F. J., 15, Broad Green, Croydon.
Stansfield, Mr. R., 7, Steele's Terrace, Haverstock Hill, N.W.
Stanswood, Mr. J., 277, Commercial Road, Landport.
Stanway, Mr. W. H., Kington, Herefordshire.
Staples, Mr. C. A., 47, High Street, Fulham, S.W.
Staples, Mr. E., West Street, Wilton.
Stark, Mr. J. S., 9, Clayton Street East, Newcastle-on-Tyne.
Starkie, Mr. R. S., 441, Strand, W.C.
Stead, Mr. T., New Briggate, Laisterdyke.
Stead, Mr. T. B., 20, Upperhead Row, Leeds.
Stedman, Mr. H. B., 58, Bold Street, Liverpool.
Steel, Mr. F. W., 283, Liverpool Road, Islington, N.
Stenhouse, Dr. J., F.R.S., 17, Rodney Street, Pentonville, N.
Stenson, Mr. J., High Street, Camden Town, N.W.
Stephenson, Mr. F., 16, Howe Street, Edinburgh.
Stephenson, Mr. J. N., High Street, Heckmondwike.
Sterriker, Mr. J., Driffield.
Stevens, Mr. F., 51, Judd Street, Euston Road, W.C.
Stevens, Mr. J., High Street, Broseley, Salop.
Stevens, Mr. P. A., 70, Hyde Road, Hoxton, N.
Stevenson, Mr. R., Victoria Street, Derby.
Stevenson, T., M.D., F.C.S., 21, Caversham Road, N.W.
Stevenson, Mr. W., The Crescent, Todmorden.
Stevenson, Mr. W. L., 165, Edgware Road, W.
Steward, Mr. J., Broad Street, Kingswinford, Staffs.
Stewart, A. D., M.B., 39, Regent Street, Greenock.
Stewart, Mr. A. Y., Apothecaries Hall, Blackfriars, E.C.

Stewart, Mr. E. H., Royal South Hants Infirmary, Southampton.
Stewart, G. C., F.C.S., Sugar Refiner, Greenock.
Stewart. Mr. J., 8, Cadzow Street, Hamilton.
Stiell, Mr. G., Dunfermline.
Stiles, Mr. M. H., 300, High Holborn, W.C.
Stoakes, Mr. B. M., 16, Whitefriargate, Hull.
Stoddart, Mr. J., 14, Grace Terrace, Chester Road, Sunderland.
Stoddart, W. W., F.C.S., F.G.S., 1 & 2, Park Street, Bristol.
Stoddart. Mr. W. W. B., 9, North Street, Bristol.
Stoker, Mr. G. N., The Laboratory, Somerset House, W.C.
Stone, Mr. F. W., 166, Fore Street, Exeter.
Stone, Mr. J. J., Devonshire House, Alton.
Storey, Mr. E. H., 42, Castle Street East. Oxford Street, W.
Storrar, Mr. D., 228, High Street, Kirkcaldy.
Stott, W., Ph.D., Sowerby Bridge.
Strachan, Mr. A., 111, George Street, Aberdeen.
Strangroom, Mr. F., Cley-next-the-Sea, Dereham, Norfolk.
Strawson, Mr. G. F., 99, Woodstock Road, Finsbury Park, N.
Strickett, Mr. J., 161, St. George's Road, Peckham, S.E.
Strongitharm, Mr. W. G., 3, High Street, South Norwood, S.E.
Stroud, Mr. J., 23, Wine Street, Bristol.
Stuart, Mr. J. E., 172, New Bond Street, W.
Sugden, Mr. S., Waterfoot, near Manchester.
Sumner, Mr. R., 50A, Lord Street, Liverpool.
Sunner, Mr. R., 108, Patrick Street, Cork.
Sutcliffe, J., L.D.S., 44, New Market Street, Bradford.
Sutcliffe, Mr. J., 154, Larkhall Lane, Clapham, S.W.
Sutterby, Mr. J. N., Long Sutton, Lincs.
Sutton, F., F.C.S., Bank Plain, Norwich.
Swaine, Mr. J., 158, Bolton Road, Bradford.
Swan, Mr. J. W., 15, Mosley Street, Newcastle-on-Tyne.
Swenden, Mr. J., 14, High Row, Darlington.
Swift, Mr. T. N., 38, Cross Church Street, Huddersfield.
Swift, Mr. W. P., Raunds, near Thrapstone, Northamptonshire.
Swingburn, Mr. R. H., 33, Broad Street, South Molton, Devon.
Swinn, Mr. C., 125, Upper Moss Lane, Hulme, Manchester.
Swinnerton, Mr. W., 70, High Street, Princes End, Tipton.
Swire, Mr. S., New Park Road, Brixton Hill, S.W.
Sykes, E. J., F.M.S., 5, The Quadrant, Buxton, Derbyshire.
Sykes, Mr. T. H., Lord Street, Southport.
Symes, Dr. C., 14, Hardman Street, Liverpool.
Symington, Mr. T., 4, Dundas Street, Edinburgh.
Symons, W., F.C.S., 26, Joy Street, Barnstaple.

Tait, L., F.R.C.S., 7, Great Charles Street, East Row, Birmingham.
Tamplin, Mr. E. C., Kingston-on-Thames.
Tanner, Mr. A. E., 128, Prescott Road, Fairfield, Liverpool.
Taplin, Mr. W. G., 75, Hampstead Road, N.W.
Targett, Mr. C. G., 53, St. Thomas Street, Weymouth.
Tate, Mr. J. L., 51, Ellerby Lane, Leeds.
Taubman, Mr. R., 33, Southampton Row, W.C.
Taylor, Mr. A., 6, South Clerk Street, Edinburgh.
Taylor, Mr. B., Briggate, Leeds.
Taylor, Mr. C., 10, Cleveland Square, Liverpool.
Taylor, Mr. C. W., 300, Holborn, W.C.
Taylor, Mr. E., 24, Yorkshire Street, Rochdale.
Taylor, Mr. E., St. George's Square, Droitwich.
Taylor, Mr. F., Address unknown.
Taylor, Mr. F., Gowthorpe Street, Selby.
Taylor, Mr. G. S., 13, Queen's Terrace, St. John's Wood, N.W.

Taylor, Mr. J., 13, Baker Street, W.
Taylor, Mr. J. H., James Street, Harrogate.
Taylor, Mr. R., Ryde, Isle of Wight.
Taylor, Mr. R., Church Green East, Redditch.
Taylor, Mr. S., 70, Great George Street, Leeds.
Taylor, Mr. T., Newport Pagnell.
Taylor, Mr. T., 81, High Street, Peckham, S.E.
Taylor, Mr. W. G., Hungerford, Berks.
Taylor, Mr. W. G., Charford Mill, Bromsgrove.
Tebb, Mr. J., Address unknown.
Teed, Mr. D., 38, Strand, Exmouth.
Telfer, Mr. H. V., Leytonstone, Essex.
Tennent, Dr. G. P., 120, Bath Street, Glasgow.
Terry. Mr. T., 1, Egerton Crescent, Withington, Manchester.
Thatcher, Mr. T., 290, Catherine Street, Ashton-under-Lyne.
Thomas, Mr. H., 7, Upper St. Martin's Lane, W.C.
Thomas, Mr. J., Bridge, Canterbury, Kent.
Thomas, Mr. J., Machynlleth.
Thomas, Mr. J. D. D., 144, Ashley Road, Bristol.
Thomas, Mr. J. J., Garstans, Lancs.
Thomas, Mr. M., Taffswell, Cardiff.
Thomas, Mr. R., Burnley.
Thomas, Mr. R., 143, High Street, Merthyr.
Thomas, Mr. W. J., 9, Commercial Place, Aberdare.
Thompson, Mr. A., 51, English Street, Carlisle.
Thompson, Mr. C. H., Maidenhead.
Thompson, Mr. G., Alston.
Thompson, Mr. H., 101, Southwark Street, S.E.
Thompson, Mr. H. A., 22, Worship Street, Finsbury Square, E.C.
Thompson, Mr. H., 8, Moor Street, Sunderland.
Thompson, Mr. J., 11, Aldersgate Street, E.C.
Thompson, Mr. J., High Street, Knaresboro', Yorkshire.
Thompson, Mr. J. W., Bull Ring, Sedley, near Dudley.
Thompson, Mr. L., Richmond, Yorks.
Thompson, Dr. R. E., F.C.S., 9, Cranley Place, South Kensington, S.W.
Thompson, Mr. T., Market Place, Richmond, Yorks.
Thompson, Mr. W. M., 31, Coney Street, York.
Thomson, W., F.R.S.E., Royal Institution, Manchester.
Thonger, Mr. G., Harborne, Birmingham.
Thorburn, Mr. H., 3, Newgate Street, Bishop Auckland.
Thorn, Mr. J. J., 338, Oxford Street, W.
Thornley, Mr. C., Stow-on-the-Wold.
Thornton, Mr. H., 136, Leeds Road, Bradford.
Thornton, Mr. S., Beacon, Exmouth, Devon.
Thorp, W., junr., B.Sc., F.C.S., 39, Sandringham Road, Kingsland, E.
Thresh, J. C., F.C.S., Buxton, Derby.
Thrower, Mr. E. A., Diss.
Thurland, Mr. H., 41, St. Giles Road, Oxford.
Thurlby, Mr. G., High Street, Gorleston, Great Yarmouth.
Thurlow, Mr. H., Ixworth, Suffolk.
Tibbles, Mr. J. T., Mount Sorrel, Leicestershire.
Tibbles, Mr. W., Market Place, Mount Sorrel, Leicestershire.
Tibbs, Mr. F., 81, Chalk Farm Road, N.W.
Tice, Mr. R., St. Stephen's, Norwich.
Tichborne, C. R. C., Ph.D., F.C.S., 40, Mary Street, Dublin.
Tidman, Mr. W., 21, Wilson Street, Finsbury, E.C.
Tilden, W. A., D.Sc., F.C.S., Clifton College, Bristol.
Tilsley, Mr. J., Berriew, Montgomeryshire, North Wales.
Tily, Mr. C. A., 45, Maida Vale, W.
Tippett, Mr. B. M., 3, Sloane Street, S.W.

Tipping, Mr. T. J. W., 155, High Street, Stoke Newington, N.
Tipton, Mr. St. John, St. George's, Wellington, Salop.
Tirrell, Mr. J., Market Square, Hanley.
Titley, Mr. T., 44, Charlotte Street, Fitzroy Square, W
Tod, Mr. J., 127, Gosford Street, Coventry.
Todd, Mr. J., English Street, Carlisle.
Todd, Mr. R. P., 16, Robertson Street, Hastings.
Todd, Mr. T., Colinsburgh, N.B.
Tollinton, Mr. R. B., Colliergate, York.
Tomlinson, Mr. H. J., Barton-on-Humber.
Tomlinson, Mr. J., 97, Fishergate, Preston, Lancs.
Toone, Mr. J. A., 2, Montpellier Exchange, Cheltenham.
Toone, Mr. J. H., 82, Granby Street, Leicester.
Toone, Mr. J. V., 14, New Bond Street, Bath.
Towerzey, Mr. A., 7, Regent Street, Clifton, Bristol.
Townend, Mr. J. W., West Auckland, Durham.
Townsend, Mr. C., 4, Union Street, Bristol.
Tremeer, Mr. J. J., 65, Boutport Street, Barnstaple.
Trick, Mr. W. B., Green Lanes, Stoke Newington, N.
Trim, Mr. E., 9, Wellington Terrace, Bournemouth, Hants.
Tritton, Mr. C., Bramerton House, Hampton Road, Bristol.
Troake, Mr. M. H., Helston, Cornwall.
Troake, Mr. R. J., 126, White Ladies' Road, Clifton, Bristol.
Troake, Mr. W. H., Kingsbridge, Devon.
Troke, Mr. C., Oakfield Road, Penge, Surrey.
Trotman, Mr. A. C., 16, Cambridge Street, Hyde Park Square, W.
Trotter, Mr. J., East Linton, Prestonkirk.
Troughton, Mr. C., 72, Old Hall Street, Liverpool.
Truman, Mr. H. V., 14, Grosvenor Road, South Norwood, S.E.
Tuck, Mr. G. F., Fore Street, Tiverton, Devonshire.
Tucker, Mr. C., Bridport.
Tucker, Mr. H. S., 139, Great Hampton Row, Birmingham.
Tucker, Mr. R. L., 9, North Street, Bristol.
Tully, Mr. J., senr., Glen Vue Works, East Grinstead, Sussex.
Tupholme, Mr. E. H., 394, King's Road, Chelsea, S.W.
Tupholme, Mr. J. T., 1, Coleherne Terrace, West Brompton, S.W.
Turner, Mr. C. E., 63, Great Russell Street, W.C.
Turner, Mr. G., Honiton.
Turner, H., M.R.C.S., Toad Lane, Rochdale.
Turner, Mr. J., Chemical Works, Queen's Ferry, Flintshire.
Turner, Mr. J., Beaumont Street, Hexham.
Turner, Mr. J., Kingsbury Square, Aylesbury.
Turner, Mr. J. K., Cleator Moor, *via* Carnforth, Cumberland.
Turner, Mr. R., Oundle, Northamptonshire.
Turney, Mr. S. B., 183, Union Street, Plymouth.
Turton, Mr. R. C., 70, Lansdown Road, Clapham, S.W.
Tuson, Prof. R. V., F.C.S., Royal Veterinary College, Camden Town, N.W
Twaddle, Mr. R., 34, Maitland Street, Glasgow.
Twemlow, Mr. R., 91, Upper Brook Street, Manchester.
Twinberrow, Mr. J., 53, Broad Street, Worcester.
Tyler, Mr. T., High Street, Stourport.
Tyrer, Mr. T., Garden Wharf, Battersea, S.W.

Umney, C., F.C.S., 50, Southwark Street, S.E.
Upton, Mr. E. J., Wallingford, Berks.
Urwick, Mr W. W., 60, St. George's Road, Pimlico, S.W.

Vaughan, Mr. W. G., 51, North Parade, Aberystwith.
Veitch, Mr. W., 300, Holborn, W.C.
Vennall, Mr. G., Cranleigh, Guildford.

Verity, Mr. R., 35, Warwick Street, Regent Street, W.
Vidler, Mr. W. T., 8, Chalk Farm Road, N.W.
Vince, Mr. J., 37, Cheapside, Lancaster.
Vipond, Mr. W. D., Middleton Teesdale, Durham.
Virgo, Mr. C., The Foregate, Worcester.
Vizer, Mr. E. B., Belgrave House, Church Road, Cliftonville, Brighton.
Voce, Mr. W. G., Prospect House, High Street, Netherton, near Dudley.
Voelcker, Dr. A., F.R.S., 39, Argyll Road, Kensington, W.

Wade, Mr. W., 6, Lewisham High Road, New Cross, S.E.
Wakefield, Mr. C. H., Blackmore House, Malvern Wells.
Wakeham, Mr. C., Helston.
Walkden, Mr. J., 8, Wesley Street, Higher Tranmere, Cheshire.
Walker, Mr. B. W., 26, Clapham Road, S.W.
Walker, Mr. C., 8, Cannon Street Road, E.
Walker, Mr. J., 124, High Street, Tewkesbury.
Walker, Mr. J., 200, Manchester Road, Bradford, Yorkshire.
Walker, Mr. J. D., 1, Abbey Street, Carlisle.
Walker, J. F., M.A., F.C.S., 16, Gilligate, York.
Walker, Mr. T., Uddingston, near Glasgow.
Wallace, Mr. W., 71, St. Vincent Street, Glasgow.
Wallwork, Mr. J., 94, Elliott Street, Tyldesley, near Manchester.
Walpole, Mr. W., White Lion Road, Yarmouth.
Walters, Mr. R., Hooley Hill, near Manchester.
Walton, Mr. D., Rusholme Road, Manchester.
Walton, Mr. G. R., Richmond, Yorkshire.
Walton, Mr. J., 298, High Street West, Sunderland.
Walton, Mr. M. F., Sowerby Bridge.
Walton, Mr. R., High Street, Maidenhead.
Wand, Mr. S., 18, Haymarket, Leicester.
Ward, G., F.C.S., Mechanics' Institution, Leeds.
Ward, Mr. J., 39, Eastgate Street, Gloucester.
Ward, Mr. J. S., Colliergate, York.
Ward, Mr. W., Hyde Hill, Berwick-on-Tweed.
Warneford, Mr. F., 50, Queen's Road, Brighton.
Warner, Mr. C. H., 55, Fore Street, E.C.
Warner, Mr. G. T., 1, Mall, Clifton, Bristol.
Warrell, Mr. E., 202, Caledonian Road, N.
Warren, Mr. G., 15, Guilford Road, Brighton.
Warriner, Mr. C. W., Corner Union Road, St. Ann's Well Road, Nottingham.
Warrior, Mr. H., Northallerton.
Warwick, Mr. D. H., Milbank Crescent, Hartlepool.
Wastie, Mr. F., 183, Lower Kennington Lane, S.E.
Waterall, Mr. G. E., Chapel Bar, Nottingham.
Waterfall, Mr. W., 14, Sea View Terrace, Plymouth.
Waterhouse, Mr. J., Stamford Buildings, Ashton-under-Lyne.
Waters, Mr. H. G., Emsworth, Hants.
Watkins, Mr. W. H., 19, Castle Street, Tredegar.
Watkinson, Mr. J. W., Kearsley, Farnworth, Bolton.
Watling, Mr. A.
Watmough, Mr. H., 26, Cleethorpe Road, Great Grimsby, Lincs.
Watson, Mr. D., Park Crescent, Torquay.
Watson, Mr. J. (Messrs. Hirst & Co.), Aire Street, Leeds.
Watson, Mr. J. E. H., Rose Corner, Norwich.
Watson, Mr. J. H., 30, Saltaire Road, Shipley, Leeds.
Watson, Mr. M., 33, Prudhoe Street, Newcastle-on-Tyne.
Watson, Mr. R. T., 63, Ormonde Street, Jarrow.
Watson, Mr. T. D., 23, Cross Street, Finsbury, E.C.
Watts, Mr. C. C., Cliftonville, Brighton.

Watts, J., D.Sc., F.C.S., 57, Baker Street, W.
Watts, Mr. J., Dudley Hill, Bradford, Yorks.
Watts, Mr. L. R., 175, Pond Street, Sheffield.
Watts, Mr. W., 10, Bedford Terrace, Kensington, W.
Watts, Mr. W. M., 32, Lower Whitecross Street, E.C.
Watts, W. M., D.Sc., F.C.S., Giggleswick Grammar School, Settle, Yorks.
Waugh, Mr. J., 178, Chapel Street, Salford.
Wealthall, Mr. A., 156, Great Jackson Street, Hulme, Manchester.
Weaver, Mr. T., The Dispensary, Paradise Street, Birmingham.
Webb, Mr. E. A., Salisbury House, Turnham Green, W.
Webber, Mr. C. F., Market Place, Sidmouth, Devon.
Webster, Mr. E. P., Dispensary Lane, Newcastle-on-Tyne.
Webster, Mr. J., Buckie, Banffshire.
Webster, Mr. S. M., 33, Bridge Street, Warrington.
Welberry, Mr. G., Bridge Gate, East Retford.
Welborn, Mr. G., The Dispensary, Grantham.
Welborne, Mr. G., Boughton-under-Blean, near Faversham, Kent.
Welch, Mr. C., 161, King's Road, Reading.
Welch, Mr. T., 29, Mosley Street, Newcastle-on-Tyne.
Weller, G., J.P., Queen's Terrace, Windsor.
Wells, Mr. T., 2, Shirland Road, Maida Vale, W.
Welton, Mr. H., 5, Bishop Street, Coventry.
West, Mr. E. R., 17, Strand, Dawlish.
West, Mr. T., 61, Chester Road, Stretford, Manchester.
West, Mr. W., 15, Horton Lane, Bradford.
Westlake, Mr. J., 4, High Street, Sutton.
Weston, Mr. C., 4, Regent's Parade, Mill Street, Ventnor, Isle of Wight.
Weston, Mr. G., South Street, Sleaford, Lincs.
Weston, Mr. S. J., 151, Westbourne Terrace, W.
Westrup, Mr. J., 76, Kensington Park Road, W.
Westwood, Mr. A., 173, Dudley Road, Brierley Hill.
Wheeldon, Mr. J., 241, Stockport Road, Manchester.
Wheeler, Mr. C., Red Lion Street, Redditch, Worcestershire.
Wheeler, Mr. J. W., 1, Jermyn Street, St. James, S.W.
Whewell, G., F.C.S., Exchange Chambers, Blackburn.
While, Mr. W. J., 123, London Street, Reading.
Whincup, Mr. W., 404, Essex Road, Islington, N.
White, Mr. E. A., Mayfield, Sussex.
White, Mr. F., London Road, Nottingham.
White, Mr. G. H., 39, Commercial St., Mountain Ash, Glamorganshire.
White, Mr. J. W., 52, Royal York Crescent, Clifton, Bristol.
White, Mr. W., 15, Westgate, Bradford, Yorks.
Whitfield, Mr. H., 45, High Street, Worcester.
Whitfield, J., F.C.S., 113, Westbro', Scarborough.
Whitla, Mr. J., Monaghan, Ireland.
Whittaker, Mr. E., 32, Regent Road, Salford, Lancs.
Whittle, Mr. S., Leigh, Lancashire.
Whittles, Mr. H., 44, Wheeler Street, Lozells, Birmingham.
Whysall, Mr. W., Grantham.
Whyte, Mr. J. S., 10½, Eglinton Street, Glasgow.
Whyte, Mr. W., 556, St. Vincent Street, Glasgow.
Wiggin, J., F.C.S., 34, St. Matthew's, Ipswich.
Wiggins, Mr. H., Oak House, Blue Anchor Road, Bermondsey, S.E.
Wild, Mr. F., 299, Oxford Street, Manchester.
Wild, Mr. J., Clarendon Place, Hyde, Cheshire.
Wilday, Mr. G. E., Market Place, Bicester, Oxon.
Wildsmith, Mr. E., 94, West Street, Leeds.
Wiles, Mr. E., 1, Mitchell Street, Sheffield.
Wilford, Mr. J., 7, Lower Parliament Street, Nottingham.
Wilkes, Mr. J. S., 16, Sparkenhoe Street, Leicester.

Wilkinson, Mr. B. J., 1, Middleton Road, Kingsland, E.
Wilkinson, Mr. G., 267, Waterloo Road, Manchester.
Wilkinson, Mr. T., 270, Regent Street, W.
Wilkinson, Mr. W., 114, Lambeth Walk, S.E.
Wilkinson, Mr. W., Hope Street, Crook, Durham.
Wilkinson, Mr. W., 263, Cheetham Hill, Manchester.
Wilks, Mr. M., 70, Fargate, Sheffield.
Willan, Mr. R., 4, Newton Street, Ulverston.
Willan, Mr. W., 3, Friargate, Preston, Lancs.
Williams, Mr. C. J., 4, St. John's, Warwick.
Williams, Mr. E., Cerrig-y-Druidion, Denbighshire.
Williams, Mr. E., 10, Wrexham Street, Mold.
Williams, Mr. G. L., Burnham, Somerset.
Williams, Mr. H. W., 1, High Street, Barmouth.
Williams, J., F.C.S., 16, Cross Street, Hatton Garden, E.C.
Williams, Mr. J., 72, Camp Hill, Birmingham.
Williams, Mr. J. D., Turret House, Bodmin, Cornwall.
Williams, Mr. J. J., 13, Desboro' Place, Harrow Road, Paddington, W.
Williams, Mr. J. V., St. Alban's House, Weymouth.
Williams, Mr. R., St. Clears, Carmarthenshire.
Williams, Mr. R., 324, Coldharbour Lane, Brixton, S.W.
Williams, Mr. T., 2. Bridge Street, Aberystwith.
Williams, Mr. T., 11, Bute Street, Cardiff.
Williams, Mr. W., 265, Crown Street, Liverpool.
Williams, Mr. W. H., 13, Upper Baker Street, W.
Williams, Mr. W. H., Hayle.
Williams, Mr. W. J., 137, Cannon Street, E.C.
Williams, Mr. W. P., Long Row, Nottingham.
Williamson, Mr. T. U., Gosford Street, Coventry.
Willis, Mr. B. W., 59, High Street, Evesham.
Willmott, Mr. W., King's College Hospital, W.C.
Willmott, Mr. W., The Brewery, Sheffield.
Wills, Mr. G. V. S., 4, Barkham Terrace, Lambeth Road, S.E.
Willsher, Mr. S., High Street, Tenterden.
Wilson, Mr. C. F., 23, Liverpool Road, Stoke-on-Trent.
Wilson, Mr. G., 40, Cathcart Street, Greenock, N.B.
Wilson, Mr. H., 19, Rusholme Road, Manchester.
Wilson, Mr. J., General Infirmary, Derby.
Wilson, Mr. J., 35, High Street, Perth.
Wilson, Mr. J., Penrith, Cumberland.
Wilson, Mr. J. H., 10, West Park, Harrogate.
Wilson, Mr. J. P., 115, London Street, Reading.
Wilson, Mr. R., Clay Cross, Chesterfield.
Wilson, Mr. R. M., Nefyn, Carnarvonshire.
Wilson, Mr. T., Stowmarket.
Wilson, Mr. T. W., 3, Bootham, York.
Wilson, Mr. W., 21, High Street, Hanley, Staffordshire.
Windsor, Mr. G., East Cornwall House, Torpoint, Devonport.
Wing, Mr. G. N., Melton Mowbray.
Wing, Mr. Lewis, Chislehurst, W., Kent.
Wink, Mr. J. A., 5, Barge Yard, Bucklersbury, E.C.
Wood, Mr. A., 1, Belle Vue Place, Great Malvern.
Wood, Mr. E. B., 46, Holloway Head, Birmingham.
Wood, Mr. R., 25, Mill Street, Macclesfield.
Wood, Mr. W. A., 81, Church Street, Hunslet, Leeds.
Wood, Mr. W. H., Front Street, Arnold, Notts.
Woodcock, Mr. J., 15, Southgates, Leicester.
Woodcock, R. C., F.C.S., Royal Agricultural College, Cirencester.
Woodhead, Mr. J. T., 29, Paradise Street, Liverpool.
Woodhead, W. H., M.D., N.Y., 58, Grosvenor Street, Manchester.

Woodland, Mr. W. F., Chard, Somersetshire.
Woods, Mr. J., North Street, Chichester.
Woodward, Mr. J. L., Bridgewater.
Woolcott, Mr. C., 49, Upper Parade, Leamington.
Woolley, Mr. G. S., 69, Market Street, Manchester.
Woolley, Mr. H., Moulton, near Spalding.
Woolley, Mr. H., 69, Market Street, Manchester.
Woolrich, Mr. C. B., Uttoxeter, Staffs.
Woolstencroft, J., Carnforth, N. Lancashire.
Wooster, Mr. J. R., 4, Broadway, Turnham Green, W.
Wootton, Mr. A. C., Grove House, Shacklewell, E.
Wootton, Mr. P., George Street, Luton, Beds.
Worfolk, Mr. F., 57, Bridge Street, Bolton.
Worth, Mr. E., Town Hall, Bournemouth.
Worthington, J. P., L.R.C.P., L.R.C.S., Edin., Russell Road, Garston.
Worthington, Mr. W., 2, Camden Place, Preston.
Wright, Mr. A., 109, High Street, Lowestoft.
Wright, Mr. A., 441, Strand, W.C.
Wright, C. R. A., D.Sc., F.C.S., Chemical Laboratory, St. Mary's Hospital, W.
Wright, Mr. C. W., Marlbro' Lodge, Marlbro' Hill, Bristol.
Wright, F., L.S.A., Stamford Bridge, York.
Wright, Mr. G., 102, High Street, Burton-on-Trent.
Wright, Mr. G., 29, Congreve Street, Birmingham.
Wright, Mr. G. H., 103, Boro' High Street, S.E.
Wright, Mr. J., 165, King Street, Yarmouth.
Wright, Mr. W. F., 30, Regent Street, Leamington.
Wright, Mr. W. O., 55, Great Scotland Road, Liverpool.
Wyatt, Mr. H., 20, Derby Road, Bootle, Liverpool.
Wyke, Mr. J., 51, Cross Street, Abergavenny.
Wyles, Mr. W., 338, Oxford Street, W.
Wyley, Mr. J., Coventry.
Wyley, Mr. W. F., Hertford Street, Coventry.
Wyllie, Mr. A., 287, High Street, Glasgow.
Wyman, Mr. J., 122, Fore Street, Cripplegate, E.C.
Wynne, Mr. E. P., 3, Pier Street, Aberystwith.

Yarde, Mr. G., 60, Lamb's Conduit Street, W.C.
Yardley, Mr. E., Ruabon, Denbighshire.
Yates, Mr. F., 64, Park Street, Southwark, S.E.
Yeomans, Mr. J., Sydney Street, Cambridge.
Yewdall, Mr. E., 56, Wade Lane, Leeds.
Young, Mr. A., 74, Nelson Street, Tradeston, Glasgow.
Young, C., F.R.C.S., Edin., 50, Ann Street, Dundee.
Young, Mr. D., Park Street, Cirencester.
Young, Mr. J., 16, Gallowtree Gate, Leicester.
Young, Mr. J., 20, High Street, Newport, Mon.
Young, Mr. J., Folds Road, Bolton.
Young, J., M.D., 5, Howard Street, Sheffield.
Young, Mr. J. R., Sankey Street, Warrington.
Young, Mr. J. R., 17, North Bridge, Edinburgh.
Young, Mr. R. F., New Barnet.
Young, Mr. W., 8, Neeld Terrace, Harrow Road, W.

NOTICE.

Members will please report any inaccuracies in these lists to
PROFESSOR ATTFIELD, *Hon. Gen. Sec.*,
17, *Bloomsbury Square, London, W.C.*

BRITISH PHARMACEUTICAL CONFERENCE.
1877-8.

ALPHABETICAL LIST OF TOWNS AT WHICH MEMBERS RESIDE.

The names to which an asterisk is attached are those of Local Secretaries. For Alphabetical List of Names, see page 350.

Aberayron.
Griffiths, W.
Jones, J. P.

Aberdare.
Sims, W.
Thomas, W. J.

Aberdeen.
Davidson, C.
McGregor, G. (Ellon.)
Rattray, W.
Strachan, A.

Aberdeen (Old).
Ross, R.

Abergavenny.
Wyke, J.

Abergele.
Lloyd, E., jun.

Aberystwith.
Davies, D. J.
Davies, J. H.
Vaughan, W. G.
Williams, T.
Wynne, E. P.

Accrington.
Astin, E.
Cooper, M. (Church.)

Airdrie, N.B.
Harvie, J.

Alford, Lincs.
Bryant, R. W.
Shaw, C. J.

Alfreton.
Robinson, J. S.

Alnwick.
Newbigin, J. L.
Simpson, G.

Alston.
Thompson, G.

Alton.
Stone, J. J.

Altrincham.
Hughes, E.

Alva (Stirlingshire).
McNicol, J.

Ambleside.
Bell, T.
Kirkby, R.

Anerley.
Bullock, F.

Anstruther.
Fortune, R.

Appleby.
Longrigg, J.

Arbroath.
Burn, D. H.
Milne, P.
Ogilvie, W. O.

Ardrossan.
Gemmell, H.

Arundel.
Price, T. U

Ashby-de-la-Zouch.
Cooper, A.
Johnson, S. E.

Ashford, Kent.
Ingall, J.

Ashton-under-Lyne.
Belfield, W.
*Bostock, W
Hirst, J.
Thatcher, T.
Waterhouse, J.

Atherstone.
Orme, W.

Axminster.
Gunn, F. J.
Pryer, W. S.

Aylesbury.
Turner, J.

Ayr.
Burns, W.
Dobbie, J.

Bacup.
Mace, J.

Bakewell.
Coates, A.

Bampton.
Gare, W.

Banbury.
Linnett, S. S.
Simpson, T.
(Bloxham.)

Banchory.
Lunan, A.

Bangor.
Griffith, J. E.
Roberts, M.

Barmouth.
Williams, H.

Barnard Castle.
Gardner, W.
Gibson, B. W.

Barnsley.
Ellison, J. B.
(Wombwell.)
Iberson, J.

Barnstaple.
Goss, S.
Symons, W.
Tremeer, J. J.

Barrow.
Willan, R.

Barton-on-Humber.
Tomlinson, H. J.

Basingstoke.
Sapp, A.

Bath.
Appleby, E. J.
Barnitt, F.
Brooke, C.
Commans, R. D.
Ekin, C.
Helmore, W. H.
Hillier, H.
Hughes, J. E.
Marsh, J. H.
Merrikin, J. B.
*Pooley, J. C.
Toone, J. V.

Bathgate.
Frieland, J.

Beccles.
Count, S.

Beckenham, Kent.
Day, T. S.

Bedale.
Bellamy, R.
Hawkin, J.

Bedford.
Cuthbert, J. M.
Masters, H. J.
Norman, J. S.

Beeston.
Faull, E.

Belfast.
Ball, T.
Davidson, F.
Glover, G. T.
Haslett, J. H.
Hodges, J. F.
Hodges, J. F. W.
Morris, S. H.
Payne, J. C. C.
Pring, R. W.

Belper, Derby.
Burkinshaw, W. T.

Berriew.
Tilsley, J.

Berwick-on-Tweed.
Carr, W. G.
Ward, W.

Betley, Staffs.
Place, W. B.

Beverley.
Hobson, C.

Bewdley.
Newman, R.

Bicester.
Sandiland, R. B.
Wilday, G. E.

Biggleswade.
Maxwell, G. N.

Bilston.
Gray, C.
Kearnes, R. H.
Lloyd, G. H.

Bingley, Yorks.
Perfect, R.
Skirrow, W. E.

Birkenhead.
Bennett, H.
Cooke, W. K.
Darwin, G. H.
*Dutton, J.
Fawcett, J.
Foulkes, W. J.
Mullock, R.
Nicholson, H.
Shaw, R. H.

Birmingham.
Arblaster, C. J.
Atkins, W. S.
Barclay, T.
Bates, J.
Canning, C.
Clayton, F. C.
Dewson, S.
Foster, J. A.
Grady, F.
Haydon, W. F.
Holdsworth, T. W.
Jones, J. A.
Kimberley, W.
Lear, G. H.
Miller, W. C.
Oxborrow, E.
Palethorpe, S.
Perry, G. E.
Plant, G. W.
Sanderson, H.
Snape, E.
Southall, A.
Southall, W.
Tait, L.
Thonger, G.
Tucker, H. S.
Weaver, T.
Whittles, H.
Williams, J.
Wood, E. B.
Wright, G.

Bishop Auckland.
Armstrong, J.
Dobinson, T.
Harburn, R. H.
*Leigh, J. J.
Thorburn, H.

Bishop's Castle.
Owen, J.

Bishop Stortford.
Speechly, G.

Blackburn.
Bickerdike, W. E.
Booth, J.
*Farnworth, W.
Moulden, W.
Openshaw, G. H.
Whewell, G.

Blackpool.
Harrison, J.
Jackson, J.

Blairgowrie.
Crarar, J.
Grant, W.

Bodmin.
Williams, J. D.

Bognor.
Long, A. T.

Bolton, Lancashire.
Blain, W.
Bowker, W.
Challinor, M.
Challinor, S. M.
Cunliffe, N.
Dutton, F.
Evans, D. O.
(Farnworth.)
Harrison, R.
(Farnworth.)
Hart, J.
Hart, W.
Holmes, T.
Holstead, T.
Martin, R.
Morris, T.
(Farnworth.)
Moscrop, T.
Pownall, T. R.
Watkinson, J. W.
(Farnworth.)
Worfolk, F.
Young, J.

Borrowstowness, N.B.
Hughes, F. R.

Boston.
Fowler, W. R.
*Marshall, R.
Mells, H. (Kirton.)
Pilley, S.

Boston Spa.
Gill, H.
Rogerson, M.

Bourne.
*Mills, R. M.

Bournemouth.
Trim, E.
Worth, E.

Brackley.
Sirett, H.

Bradford-on-Avon.
Saunders, T. P.

Bradford, Yorkshire.
Appleyard, R.
Bailey, J. T.
Beanland, S.
Bell, F.
Butterworth, A.
Cockshott, W.
Drake, W. (Wyke.)
Faull, J.
Handforth, E.
Harrison, T.
Henderson, C.
Hick, J.
Jackson, J.
King, W.
Lister, S.
Metcalfe, A. A.
Newsholme, W.
Parker, W.
*Parkinson, R.
Priestley, J.
Pullan, T.
Rimmington, F. M.
Savage, J. L.
Sharp, J.
Silson, R. W.
Spencer, J.
Stead, T.
Sutcliffe, J.
Swaine, J.
Thornton, H.
Walker, J.
Watts, J.
West, W.
White, W.

Braintree.
Downing, J. G.

Brenchley, Kent.
Keene, J.

Brentwood, Essex.
Guest, E. P.

Bridge, Kent.
Thomas, J.

Bridge of Allan, N.B.
Farie, G.

Bridgend.
Powell, W.

Bridgewater.
Griffith, W. H.
Woodward, J. L.

Bridgnorth.
Hughes, H.

Bridlington Quay.
Dickins, J.

Bridport.
Beach, J.
Tucker, C.

Brierley Hill.
Geary, E.
Westwood, A.

Brigg.
Nicholson, W. O.

Brighton.
Barton, H.
Billing, T.
Cornish, W.
Dinnis, J.
Edwards, J.
Else, W.
Ettles, J.
Firman, H. E.
Foster, F.
Gibson, W. H.
Glaisyer, T.
Guy, F.
Gwatkin, J. T.
Haffenden, T.
Harris, E. R.
Histed, E.
Kemp, J.
Kent, G. F.
Long, H.
Padwick, J.
Robson, T.
Salmon, F. W.
*Savage, W. D.
Savage, W. W.
Smith, W. H.
Vizer, E. B.
Warneford, F.
Warren, G. R.
Watts, C. C.

Brill.
Holmes, F. G.

Bristol.
Ackerman, T.
Berry, W.
Boorne, C.
Boucher, J.
Bush, T. (Paulton.)
Cuff, R. C.
Dudden, R. M.
Fardon, H.
Freestone, T. M.
Gare, J.
Hartland, J.
Hatch, R. M.
Jennings, T. H.
Lockyer, W. J.
Matthews, H.
Pitman, J.
Plumley, J. G.
Samson, E.
Saunders, T. C.
Sprackett, G.
*Stoddart, W. W.
Stoddart, W. W. B.
Stroud, J.
Thomas, J. D. D.
Townsend, C.
Tritton, C.
Tucker, R. L. (Redland.)
Wright, C. W.

Briton Ferry.
Jones, M. H.

Broadstairs.
Poore, E.

Bromsgrove.
Haines, J. J.
Taylor, W. G.

Bromwich, West.
*Burch, W.
Green, J.
Holliday, T.
Roberts, G.
Robinson, A.

Broseley.
Stevens, J.

Brynmawr.
Evans, A. E.
Jones, A. M.

Buckie.
Bremner, J.
Webster, J.

Buckingham.
Kingerlee, G.

Burgh-le-Marsh.
Limon, H.

Burnham, Lynn.
Griffin, A. W.

Burnham, Somerset.
Williams, G. L.

Burnham Market.
Spencer, W. H.

Burnley.
Ashworth, T.
Hay, D. (Nelson.)
Hitchin, R.
*Thomas, R.

Burry Port.
Olive, W. T.

Burslem.
*Blackshaw, T.
Guest, G. C.
Oldham, W.

Burton-on-Trent.
Brierley, J.
Wright, G.

Bury, Lancashire.
Marsden, W. H.
Pennington, T.

Bury St. Edmunds.
Clifton, G. F.
*Floyd, J.
Hardwicke, E. J.

Bushey Heath.
Short, E. C.

Buxton.
Ball, E.
Barnett, A.
Hutchinson, J.
Sykes, E. J.
Thresh, J. C.

Callington.
Dawe, J.

Cambridge.
Church, H. J.
Crampton, J.
*Deck, A.
Yeomans, J.

Cambusland.
Clark, S. P.

Campbeltown.
Barton, A.

Canterbury.
Amos, D.
Bing, E.
*Harvey, S.

Cardiff.
Collier, J. A.
John, W. D.
Jones, J. T.
Joy, F. W.
Proctor, R. (Penarth.)
Reynolds, T. (Caerphilly.)
Thomas, M.
Williams, T.

Carlisle.
Fisher, J. J.
Foster, J.
Graham, J.
Hallaway, J.
Pattinson, J. S.
Richardson, T. J.
Robson, J.
*Thompson, A.
Todd, J.
Walker, J. D.

Carmarthen.
Jones, E. B.
Rees, D.

Carnforth.
Woolstencroft, J.

Carnoustie.
Nicol, W.

Cerrig-y-Druidion.
Williams, E.

Chapeltown.
Gibson, J.

Chard.
Churchouse, W. J. F.
Woodland, W. F.

Chatham.
Lamb, T. C.
Rossiter, J.

Chelmsford.
Baker, C. P.

Cheltenham.
Balcomb, J.
*Barron, W.
Beetham, M.
Fletcher, J.
Forth, W.
Horsley, J.
Jeffrey, T. A.
Kite, W. T.
Smith, N.
Toone, J. A.

Chertsey.
Boyce, G.

Chester.
Baxter, G.
Blelock, C. J.
Grindley, W
Hodges, W.
Marcham, J.
Mills, J.
Roberts, R. M.
*Shepheard, T.

Chesterfield.
Greaves, A.
Wilson, R.

Chester-le-Street.
Coxon, R. J.
Greenwell, R. H.
Longbotham, J.
*Robinson, Joseph (Stanley.)

Chichester.
Woods, J.

Chippenham.
Coles, J. C.

Chipping Ongar.
Chapman, R. J.

Chislehurst.
Beaumont, C. F. J. B.

Chorley.
Bradshaw, J. (Adlington.)
Oakes, G.

Chudleigh.
Cleave, W.

Church Stretton, Salop.
Phillips, J.

Cirencester.
Church, A. H.
Mason, J. W.
Smith, C. S.
Woodcock, R. C.
Young, D.

Clayton-le-Moors.
Johnson, M.

Cleator Moor.
Turner, J. K.

Cleethorpes.
Peck, F. A.

Cleobury-Mortimer.
Evans, E. P.

Clevedon.
Chapman, H.

Clifton, Bristol.
Barker, C. D.
Driver, A.
Mortimer, J.
*Schacht, G. F.
Tilden, W. A.
Towerzey, A.
Troake, R. J.
Warner, G. T.
White, J. W.

Clun, Salop.
Darroll, W.

Coalville.
Porter, J.

Cockermouth.
Cooper, W. J.
Robinson, W.

Codnor.
Farnsworth, T.

Colchester.
Cole, F. A.
Hammerton, E.

Coleford.
Cheese, H.

Colinsburgh, N.B.
Todd, T.

Collumpton.
Foster, J.

Colne, Lancashire.
Asquith, W. C.

Connah's Quay.
Jones, K. L.

Consett.
Imrie, D.

Conway.
Edwards, J.

Cork.
Allen, W. H.
Bannister, W.
Beamish, G. P.
Carnegie, W.
Cooke, J.
Harrington, W.
Jennings, F. M.
Lester, T. R.
Selkirk, J.
Spencer, W. A. C.
Sunner, R.

Cosham.
Baker, G.

Coventry.
Astley, J.
Barrett, F. J.
Glover, H.
Hands, R. M.
Hinds, J.
Hinds, W.
Hiscock, R.
Hodgkinson, G.
*Powers, E.
Tod, J.
Welton, H.
Williamson, T. U.
Wyley, J.
Wyley, W. F.

Cranbrook.
Smith, J. W.

Crawley.
Leach, J.

Crediton.
Jackson, W.

Crewe.
Gray, J. T.
Kay, J.

Crewkerne.
Greaves, J.
Harris, M. C. J.
Pearce, J.

Crieff.
Harley, J.

Cromarty.
Johnstone, W.

Crook.
Ditchburn, P.
Wilkinson, W.

Crowle.
Pickering, J.

Croydon.
Clarke, A. H.
Long, H.
Stannard, F. J.

Cullen.
Kemp, J.

Cupar, Fife.
Caw, J.

Darlington.
Robinson, A. F.
Robinson, J.
*Swenden, J.

Dartford.
Armitage, E. H.
Horrell, A. E.

Dartmouth.
Rees, W. H.

Darwen, Lancs.
Shorrock, R.

Dawlish.
Cutcliffe, G. J.
West, E. R.

Deal.
Clarabut, J. B.
McDiarmid, J. B.

Denny.
Anderson, E. H.

Derby.
Barnes, B.
Clifton, F.
Evans, B.
*Frost, G.
Monkhouse, H.
Stevenson, R.
Wilson, J.

Dewsbury.
Foster, A.
Fox, G.
Robinson, J. R.

Devonport.
Breeze, G.
*Codd, F.
Johns, T. J. R.
Windsor, G. (Torpoint.)

Diss.
Amyot, T. E.
Cupiss, F.
*Gostling, T. P.
Gostling, W. A.
Hayhoe, W.
Nicholson, D. G.
Thrower, E. A.
Whitrod, H. F.

Dolgelly.
Roberts, J. C.

Doncaster.
Hasselby, T. J.
*Howorth, J.
Parkin, C.
Shaw, H. W.

Dorchester.
Durden, H.
How, W.

Dorking.
Clift, J.

Dover.
Adams, R. W.
*Bottle, A.
Brown, J. F.
Cotterell, W. H.
Forster, R. H.
Hambrook, J. B.
Peake, H.

Driffield.
Bordass, J.
Parkinson, T.
Ross, L. B.
Sterriker, J.

Droitwich.
Taylor, E.

Dublin.
Allen, C. A.
Day, F.
Draper, H. N.
Evans, J.
Frazer, W.
Galwey, R. J.
Goodwin, J.
Hamilton, J. T.
Hartt, C.
Hayes, W.
Holmes, J. T.
Purefoy, R. D.
Scott, W.
Simpson, R.
*Tichborne, C. R. C.

Dudley.
Dawson, J.
*Dennison, M.
Fletcher, J.
Hollier, E.
Thompson, J. W. (Sedgley.)
Voce, W. G. (Netherton.)

Dufftown.
Proctor, A. D.

Dulverton.
Ocock, C.

Dumbarton.
Babtie, J.
Binnie, R.

Dumfries.
Fingland, J. (Thornhill.)

Dundee.
Anderson, A. B.
Esplin, A.
Hardie, J.
*Hodge, J.
Kerr, C.
Mason, J. B.
Miller, T. S.
Park, W.
Parker, F. C.
Russell, J.
Young, C.

Dunfermline.
Seath, A.
Stiell, G.

Dunkeld.
McDonald, K.

Dunse, N.B.
Gunn, W.

Durham.
- *Burdon, J.
- Hunter, F. N.
- Lambert, J.
- Leighton, J. H.
- Potts, J.
- Sarsfield, W.

Earlestown.
- Peake, A.

Easingwold.
- Rookledge, J.

Eastbourne.
- Hall, S.

East Dereham.
- Abram, F. W.
- Strangroom, F. (Cley.)

East Grinstead.
- Tully, J., senr.

East Retford.
- Appleby, C.
- Fletcher, F. B.
- Welbury, G.

Eastwood.
- Ault, J.
- Chambers, J.

Edinburgh.
- Ainslie, W.
- Aitken, J.
- Anderson, W.
- Archer, T. C.
- Baildon, H. B.
- Baildon, H. C.
- Blanshard, G.
- Brown, D.
- Buchanan, J.
- Dott, D. B.
- Ewing, J. L.
- Fairgrieve, T.
- Gardner, J.
- Gilmour, W.
- Guthrie, A. D.
- Howie, W. L.
- Laird, G. H.
- Macadam, S.
- Macdonald, J.
- Macfarlane, A. Y.
- McGlashan, D.
- Mackay, G. D.
- Mackay, J.
- Mackenzie, J.
- Maclagan, D.
- Meldrum, E. D.
- Midgeley, J. H.
- Moinet, F. W.
- Morrison, D.
- Napier, A.
- Niven, W. R.
- Noble, A.
- Pinkerton, W.
- Purves, S.
- Raimes, R.
- Robertson, J.
- Smiles, J.
- Smith, P. S.
- Smith, T.
- Stephenson, F.
- Symington, T.
- Taylor, A.
- Young, J. R.

Ely.
- Lincolne, N.

Emsworth.
- Waters, H. G.

Esher.
- Ling, E.

Evesham.
- Willis, B. W.

Exeter.
- Collett, C. B.
- Cooper, G.
- Delves, G.
- Gadd, H.
- Hunt, A.
- Husband, J. C.
- Napier, G. L.
- Pasmore, G.
- Stone, F. W.

Exmouth.
- Teed, D.
- Thornton, S.

Eyam.
- Froggatt, T. W.

Falkirk.
- Murdoch, D.

Falmouth.
- Newman, W. F.

Fareham.
- Batchelor, C.
- Franklin, A.

Farnham.
- Higgins, W.

Faversham.
- Lenfestey, W. G.
- Welborne, G. (Boughton.)

Ferryhill.
- Smith, R.

Fleetwood.
- Gibson, F.

Flint.
- Jones, M.

Folkestone.
- Goodliffe, G.
- Lea, J.
- Stainer, J.

Forebridge, Stafford.
- Spilsbury, J.

Forfar.
- Anderson, D. S.

Formby, Lancs.
- Blood, C.

Forres.
- Michie, J.

Foulsham, Norfolk.
- Newport, W.

Frizington.
- Allatt, F. T.

Frodsham.
- Robinson, J. F.

Gainsborough.
- Howlett, W. H.

Garstans.
- Thomas, J. J.

Gateshead.
- Elliott, R.
- Mayfield, J. T.

Glasgow.
- Adam, T.
- Black, J.
- Brodie, R.
- Buchanan, T. D.
- Campbell, J.
- Clarke, J. A.
- Cowan, —
- Currie, J.
- Currie, J.

Davison, T.
De Nance, W. C.
Dickie, J.
Fairlie, J. E.
Fairlie, J. M.
Fenwick, J.
Forrest, R. W.
Frazer, D.
Greig, W.
Guthrie, P.
Halley, A.
Harrower, P.
Hume, R.
Hunter, J. C.
Jaap, J.
Kennedy, W.
*Kinninmont, A.
Lindsay, T.
Lockhart, J.
McDonald, H. S.
McDonald, J.
Machattie, A. T.
M'Gregor, A.
McKenzie, W.
McLeod, T.
M'Millan, J.
Muir, G.
Murdoch, G.
Murdock, J.
Nicol, J.
Paris, W.
Paterson, A.
Paton, —
Pinkerton, J. S.
Rait, R. C.
Remmers, B. H.
Rose, A.
Schmidt, A.
Semple, J.
Stanford, E. C. C.
Tennent, G. P.
Twaddle, R.
Walker, T.
Wallace, W.
White, J.
Whyte, J. S.
Whyte, W.
Wyllie, A.
Young, A.

Gloucester.

Berry, E.
Cook, T.
Hume, J. W. D.
Meadows, H.
Pearce, T.
Ward, J.

Goole.

Roulston, B. W.

Gorleston, Gt. Yarmouth.

Thurlby, G.

Gosforth.

Gaitskill, J.

Gosport.

Mumby, C.

Gourock.

Barr, R.
Peters, J.

Grantham.

Cooper, H. G.
Fisher, F. D.
Hall, T.
*Hopkinson, T.
Newcome, J.
Welborn, G.
Whysall, W.

Gravesend.

Bulgin, W.
Drury, G. S.

Grays, Essex.

Soole, J. H.

Great Bedwin.

Gerard, G. R.

Great Malvern.

Wood, A.

Great Yarmouth.

Gardner, J. R.
Lee, J.
Skoulding, G. S. F.
Walpole, W.
Wright, J.

Greenock.

Armitage, G.
Baine, J. A.
Cowan, W. M.
Duncan, S.
Fisher, T.
M'Naught, A.
Stewart, A. D.
Stewart, G. C.
Wilson, G.

Grimsby.

Bottrill, G. T.
Cook, R.
Gossop, G. K.
Watmough, H.

Guernsey.

Anderson, H. D.
Arnold, A.

Guildford.

Jeffries, H.
Vennall, G. (Cranleigh.)

Guisborough.

Bancks, A.

Guiseley.

Archer, J. S.

Hadfield.

Jones, J.

Halifax.

Brook, R.
Dyer, W.
Farr, J.
*Hebden, W. C.
Illingworth, W. H.
Pedley, T. (Triangle.)

Hamilton.

Mackill, R. C.
Stewart, J

Hanley, Stafford.

Booth, R.
*Jones, C.
Lloyd, J.
Tirrell, J.
Wilson, W.

Harleston.

Borrett, H.
Muskett, J.

Harpenden.

Busby, J.

Harrogate.

Allanson, C.
*Coupland, J.
Davis, R. H.
Taylor, J. H.
Wilson, J. H.

Hartlepool.

Warwick, D. H

Harwich.

Bevan, C. F.
Harding, J.

Hastings and St. Leonards-on-Sea.
Branson, F. W.
Kernot, G. C.
Keyworth, G. A.
*Robinson, J. S.
Rossiter, F.
Snowdon, R.
Todd, R. P.

Havant.
Chignell, A.

Haverfordwest.
Saunders, D. P.

Hay.
Davies, J. L.

Hayle.
Williams, W. H.

Hebden Bridge.
Hey, D.

Heckmondwike.
Booth, J.
Stephenson, J. N.

Helenburgh.
Harvie, G.

Helmsdale.
Paterson, J.

Helmsley.
Read, W.

Helston.
Troake, M. H.
Wakeham, C.

Hereford.
McCormick, F. H.
Morris, T. H. V.

Hertford.
Durrant, G. R.

Hexham.
Bell, G.
Riddle, W. R.
*Smith, J. S. T. W.
Turner, J.

Heywood.
Jackson, J.

Higher Tranmere.
Walkden, J.

Hinckley.
Gilbert, G.
Pridmore, W.

Hindley.
Slingsby, C. S.

Hirwain.
George, J. E.
Sims, J.

Hitchin.
Ransom, W.

Holsworthy.
Oliver, J. S.

Honiton.
Lee, W.
Turner, G.

Horncastle.
Carlton, W. P

Houghton-le-Spring.
Rowell, R. H.

Huddersfield.
Cuthbert, R.
Jarmain, G.
Kaye, H.
King, W.
Rhodes, G. W.
Swift, T. N.

Hull.
Allison, E.
Anholm, A.
Baynes, J.
Baynes, J.
*Bell, C. B.
Benson, J. L.
Clarke, I.
Dixon, H.
Dixon, J.
Earle, F.
Hall, H. R. F.
Hammond, C. T.
Lowther, M. K.
Metcalfe, C. L.
Milner, J. G.
Myers, G.
Oldham, J.
Pickering, A.
Smith, T. J.
Soutter, J. S.
Staning, W.
Stoakes, B. M.

Hungerford, Berks.
Taylor, W. G.

Huntingdon.
Provost, J. P.

Hyde, Cheshire.
McClean, J.
Wild, J.

Hythe.
Lemmon, R.

Idle, Yorks.
Hopton, E.

Ilchester.
Barrett, T. G.

Ilford.
Beal, E. J.

Ilkeston.
Merry, W.
Potts, R. S.

Insch, N.B.
Craig, G.

Inverary.
Rodger, J.

Invergordon.
Sinclair, R.

Inverness.
Fraser, J.

Ipswich.
Callaway, L.
Cornell, W.
Grimwade, E.
Sayer, E. C.
*Wiggin, J.

Ironbridge.
Hartshorn, A. F.

Ironville.
Greaves, W. S.

Irvine.
Gillespie, J.

Isleham.
Diver, B.

Isle of Man.
Brearey, W. A. (Douglas.)
Carran, T. (Peel.)

Ixworth.
Thurlow, H.

Jarrow-on-Tyne.
Rose, J. D.
Watson, R. T.

Jedburgh.
Peters, J. F.

Jersey.
Ereaut, G.

Keelby, near Ulceby.
Skinner, M. H.

Kelso.
Dodds, G. F.

Kendal.
Bateson, T.
Coulter, G. (Sedbergh.)
Hind, T. W. L.
Mangnall, W.
*Severs, J.

Kenilworth.
Barton, H. E.

Keswick.
Henderson, M. J.

Kettering.
Hitchman, H.

Kidderminster.
Hewitt, G.

Kidsgrove.
Griffiths, E. H.

Kidwelly.
Glencross, W.

Kilmarnock.
Borland, J.

Kingsbridge, Devon.
Troake, W. H.

King's Lynn, *see* **Lynn.**

Kingston-on-Thames.
Brewster, W.
Tamplin, E. C.

Kingstown.
Bennett, H.

Kingswinford.
Steward, J.

Kington, Hereford.
Stanway, W. H.

Kirkcaldy.
Coutts, A. (Pathhead.)
Gorrie, A.
Macknight, S. W.
Storrar, D.

Kirkham.
Blackhurst, W. S.

Kirkintilloch.
Morton, T.

Kirriemuir.
Ford, J.

Knaresboro.
Sindall, J. W.
Thompson, J.

Lanark, N. B.
Cassels, T.

Lancaster.
*Bagnall, W. H.
Battersby, S.
Cardwell, E.
Clark, E.
Hall, W.
Johnson, C.
Vince, J.

Landport.
Ball, W.
Hackman, L. L.
Stanswood, J.

Langharne.
David, S. S.

Langholm.
Graham, W. B.

Launceston.
Eyre, J. S.

Leamington.
Barnitt, J.
Bell, W.
Bollans, E.
Cutting, J.
Davis, H.
*Jones, S. U.
Pullin, W. H.
Smith, S. A.
Spilsbury, J.
Woolcott, C.
Wright, W. F.

Lechlade, Gloucestershire.
Archer, J.
Kinch, C. J.

Ledbury, Hereford.
Freeman, E.

Leeds.
Abbott, J.
Barraclough, T.
Brooke, T.
Broughton, A.
Brown, E.
Clapham, J.
Clapham, J. W.
Clark, W. T.
Cragg, J.
Day, J.
Dunn, H.
Ebdell, J. T.
Exley, G.
Fawthorp, J.
Ferguson, W. K.
Greasley, M. F.
Hardman, J. W.
Hill, F.
Holmes, J.
Horsfield, J. N.
Iredale, G.
Iredale, T.
Jackson, W.
Jefferson, P.
Longley, J. W.
Manfield, W.
Patchett, I.
Pocklington, H.
Powell, W.
Reynolds, F.
*Reynolds, R.
Rhodes, W. H.
Saxton, J.
Smeeton, W.
Stead, T. B.
Steele, E. B.
Tate, J. L.
Taylor, B.

Taylor, S.
Ward, G.
Watson, J.
Wildsmith, E.
Wood, W. A. (Hunslet.)
Yewdall, E.

Leek, Staffordshire.
Johnson, W.

Leicester.
Burrows, H. C.
Burton, S.
Butler, E. H.
Carr, W.
Clark, J. W.
Cooper, T.
Harvey, W. R.
Lloyd, T. H.
Meadows, J.
*Richardson, J. G. F.
Salisbury, W. B.
Slater, J.
Toone, J. H.
Wand, S.
Wilkes, J. S.
Woodcock, J.
Young, J.

Leigh.
Whittle, S.

Leighton Buzzard.
Herington, J.
Richmond, R.

Leith.
Finlayson, T.

Leominster.
Davis, D. F.
Owen, S.

Lessness Heath, Kent.
Heaton, C. W.

Leven.
Gibson, A.

Levenshulme.
Botham, G.
Hall, J. T.

Lewes.
Curtis, H.
Martin, T.
Saxby, H., junr.

Leyburn.
Campbell, G.

Lincoln.
Bishop, W. M.
*Hayward, C. J.

Little Bolton.
See Bolton.

Liverpool.
*Abraham, J.
Alexander, J.
Ball, G.
Barber, G.
Barton, A. F. G.
Bathgate, W. L.
Billington, F.
Blabey, J. J. (Woolton.)
Blain, A. H.
Buck, J. M.
Buck, R. C.
Chellew, W. D.
Cohen, N. S.
Cook, E. A.
Dale, J.
Davies, E.
Driver, T. (Woolton.)
Evans, E.
Evans, E., junr.
Evans, J. J.
Evans, J. R.
Evans, R.
Ferguson, J.
Flint, J.
Fraser, A.
Furniss, T.
Greenall, A.
Hall, T.
Hallawell, J.
Hocken, J.
Holt, S.
Humphries, E.
Hunt, T.
Johnson, J. H.
Johnson, M. (Huyton.)
Jones, F.
Knowles, R.
Lee, S. W.
Lewis, R.
Lewis, S.
Lloyd, J. W.
Lumby, A.
Marson, B. B.
Martin, J.
Martin, T.
Mason, A. H.
McVitie, T.
Monkhouse, J.
Parkinson, R.
Redford, A.
Robinson, J. F.
Samuel, A. H.
Sergeant, T. W.
Shaw, J.
Smyth, T.
Stedman, H. B.
Sumner, R.
Symes, C.
Tanner, A. E.
Taylor, C.
Troughton, C.
Williams, W.
Worthington, J. V.
Woodhead, J. T.
Wright, W. O.
Wyatt, H.

Llandilo.
Hughes, T.

Llandudno.
Penney, W. S.

Llanegryn.
Pugh, H.

Llanelly.
Broom, G.
Hughes, E.

Llangefni.
Hughes, R.

Llangollen.
Jones, H.

Llanwrst.
Jones, J.

Loddon.
Ellis, T. W.

London, E.
Allen, W. H.
Arnold, G. J.
Bailey, J. H.
Banfield, H. W.
Bishop, A.
Bishop, W. B.
Bluett, W. R.
Burton, J. D.
Clark, J. A.
Dean, S.
Dixon, J. B.
Eastman, J. E.
Edwards, E.
Fox, W.

Fox, W. A.
Frost, W. T.
Glassford, J. McL.
Goodwin, J.
Granger, F. J.
Hall, T. H.
Hatfield, G. B.
Hills, H. W.
Holford, T. C.
Howard, D.
Howard, W. D.
Kernot, G. C.
Kirk, S.
Loane, J.
Nicholls, T.
Owen, R. J.
Rayson, H.
Ringrose, G.
Rogers, W.
Sharman, W.
Skipper, E.
Telfer, H. V.
Thorp, W., junr.
Tyrer, P.
Walker, C.
Wilkinson, B. J.
Wootton, A. C.

London, E.C.

Armstrong, H. E.
Attwood, A.
Barron, F.
Best, T. F.
Brown, H.
Charity, W.
Cocksedge, H. B.
Colclough, W.
Constance, E.
Crawshaw, E.
Crispe, J.
Cutforth, J. D.
Darby, S.
Evans, H. S.
Faries, T.
Fentiman, A.
Flux, W.
Foster, M. E.
Francis, G. B.
Francis, G. B., junr.
Francis, R. P.
Francis, W. H.
Froom, W. H.
Gadd, H.
Gedge, W. S.
Gething, W. B.
Good, T.
Grimwade, E. W.
Hampson, R.
Hanbury, C.
Hanbury, F. J.
Harvey, E.
Hawkins, T.
Heathfield, W. E.
Herring, H.
Hewlett, C. J.
Hill, A. B.
Hindsley, H.
Hodgkinson, C.
Hodgkinson, W.
Hooper, B.
Hopkin, W. K.
Horner, E.
Horner, E., junr.
Howden, R.
Hughes, L. S.
Hugill, J.
Huskisson, H. O.
Jones, J. H.
Knight, J.
Langdale, E. F.
Leath, J.
Lescher, F. H.
Mackey, J. B.
Marston, J. T.
Maw, C.
Owen, O. D.
Pasmore, F. R.
Pattison, G.
Pedler, G. S.
Penrose, A. P.
Pond, G. P.
Preston, J. C.
Robertson, F. F. L.
Rossiter, W.
Schacht, W.
Selleck, E.
Simmonds, P. L.
Smith, J.
Squire, A.
Squire, W.
Stewart, A. Y.
Thompson, H. A.
Thompson, J.
Tidman, W.
Warner, C. H.
Watson, T. D.
Watts, W. M.
Williams, J.
Williams, W. J.
Wink, J. A.
Wyman, J.

London, N.

Applegate, E.
Arundel, M. H.
Ball, G.
Bradley, F.
Broad, J.
Broad, J. M.
Clapp, E. F.
Colchester, W. M. junr.
Coles, F.
D'Aubney, T.
Dutchman, W.
Farrow, C. H.
Garner, T.
Handley, C.
Harris, W. W.
Heap, E.
Hodsoll, T. W. H.
Jefferson, T.
Large, J. H.
Little, H.
Lorimer, J.
Marshall, A.
Mason, H. C.
Morris, G. E.
New, W. W.
Owen, J.
Parkes, J. P.
Reboul, A. P.
Skinner, T.
Skipper, E.
Stable, R. H.
Steel, F. W.
Stenhouse, J.
Stevens, P. A.
Strawson, G. F.
Tipping, T. J. W.
Trick, W. B.
Warrell, E.
Whincup, W.
Young, R. F.

London, N.W.

Allchin, A.
Barret, E. L.
Bell, W. H.
Betty, S. C.
Biddiscombe, C.
Bindloss, G. F.
Braithwaite, J. C.
Cottrill, J. W.
Crawley, H.
Dunmore, G. H.
Glazier, W. H.
Goldfinch, G.
Greenish, T.
Greenish, T. E.
Henty, H. M.
Johnson, J.
Laws, J.
Merrell, J.
Nash, H.
Pettinger, E.
Rhind, W. W.
Sangster, A.

Souter, J. C.
Stamp, E. B.
Stansfield, R.
Stenson, J.
Stevenson, T.
Taplin, W. G.
Taylor, G. S.
Tibbs, F.
Tuson, R. V.
Vidler, W. T.
While, W. J.
Wills, J. L.

London, S.E.

Atkinson, L.
Austin, H. F.
Balchin, E. S.
Baldock, J. H.
Balls, G.
Bateman, T. H.
Bell, R. E.
Bernays, A. J.
Biddiscombe, C.
Birch, H. C.
Braby, F.
Bradley, T. D.
Brown, A. J.
Brown, H. F.
Bullock, F.
Busby, H. H.
Cardwell, E.
Churchill, H.
Clift, E.
Coldwell, D. B.
Cole, A. C.
Coles, J. W.
Congreve, G. T.
Courtenay, A.
Crisp, F. A.
Crow, E. L.
Dale, S.
Dodd, W.
Dodwell, J.
Doughty, M.
Earland, W.
Elliott, J. D.
Frost, W. T.
Gadd, R.
Green, S.
Grisbrook, S.
Hadingham, J. W.
Hall, T.
Hall, W.
Howell, M.
Izod, J.
Jones, T.
Laing, J. S.
Lavers, T. H.
Linford, J. S.
Lockyer, G.
Longman, J. H.
Marriott, T. E.
Miller, C. B.
Orpe, T. M.
Page, J.
Plowman, S.
Poingdestre, C. R.
Rabson, H.
Ridd, A. H.
Rossiter, W.
Sandy, F. W.
Sargent, D. W.
Silverlock, H. T.
Silvers, F. T.
Simpson, T.
Smith, J. B.
Smith, W. F.
Stacy, F.
Strickett, J.
Strongitharm, W. G.
Taylor, T.
Thompson, H.
Tibbs, F.
Truman, H. V.
Umney, C.
Wade, W.
Wastie, F. W.
Watling, A.
Wiggins, H.
Wilkinson, W.
Wills, G. S. V.
Wiltshire, T. P.
Wright, G. H.
Yates, F.

London, S.W.

Amoore, A. S.
Ashton, W.
Baily, J.
Barnes, J. B.
Bicknell, W.
Biffin, T.
Bourdas, I.
Bourdas, I., junr.
Brewster, W.
Brooks, C.
Burt, G. E.
Church, J.
Churchill, H.
Cooke, P.
Cooper, A.
Cromwell, O.
Curtis, T.
Deane, J.
Deering, A.
Drane, W.
Dyer, A. J.
Evans, E.
Fenn, J. W. T.
Field, A. W.
Frankland, E.
Gadd, W. F.
Gulliver, W.
Hall, F.
Hanbury, D. B.
Heath, E. A.
Hickey, E. L.
Hilder, R. T.
Hucklebridge, J. M.
Hunt, C.
Ingham, J.
Ive, W.
Jones, H. S.
Kingzett, C. T.
Lake, R.
Luff, R.
May, J.
Newby, R. J.
Palmer, P. L.
Pond, B. C.
Roach, P.
Robinson, R. A.
Rowe, R.
Schweitzer, J.
Simpson, J.
Smith, J. S.
Spyer, N.
Staples, C.
Sutcliffe, J.
Swire, S.
Thompson, R. E.
Tippett, B. M.
Tupholme, E. H.
Tupholme, J. T.
Turton, R. C.
Tyrer, T.
Urwick, W. W.
Walker, B. W.
Wheeler, J. W.
Williams, R.
Wills, J. L.

London, W.

Adlington, W. B.
Aitken, R.
Andrews, F.
Backhouse, H. N.
Barker, W. R.
Barnard, J.
Bascombe, F.
Bathe, R. S.
Bird, A.
Bird, W. L.
Blades, F.
Bowles, W. J.
Brightmore, W.
Brownen, G.

Bullen, T.
Bullock, J. L.
Burden, E. M.
Butt, E. N.
Carteighe, M.
Cawdell, G.
Clark, A. H.
Cleaver, E. L.
Clifford, T. A.
Clift, H.
Cook, R.
Cosway, E. C.
Coverley, E. C.
Cracknell, C.
Croyden, C.
Cryer, H.
Cullen, R. H.
Davies, R. H.
Dyson, W. B.
Faulkner, J. R.
Fincham, R.
Fowler, S.
Gardner, J.
Gale, S.
Gamble, H. A.
Garner, J.
Gaubert, S.
Hamilton, J.
Hardy, S. C.
Haselden, A. F.
Hayles, B. H.
Haynes, C. H.
Hemingway, A.
Hemingway, E.
Hemingway, W.
Heywood, J. S. C.
Hickman, W.
Hills, T. H.
Hills, W.
Hobson, A. S.
Hogg, R.
Holmes, W. M.
Horncastle, J.
Horsley, T. W.
Humpage, B.
Humphries, E.
Hyne, H.
Ince, J.
Jackson, C.
James, J. T.
Jewell, R. J.
Jones, W. C.
Keene, E.
Kingsford, F.
Lewinton, A. B.
Lingwood, W.
Long, H.
Luff, A. P.
Martindale, W.
Mason, R. W.
Mathews, J. H.
Matthews, W.
Maudsley, W.
Mellin, G.
Mitchell, M. F.
Moyle, J.
Newton, T. A. C.
Nowell, B.
Nutt, A. J.
Palmer, G. D.
Pickard, W.
Postans, A. W.
Prichard, E.
Probyn, C.
Reichardt, E.
Reynolds, J. J.
Richardson, B. W.
Richardson, G.
Robbins, J.
Sandford, G. W.
Sanger, W. A.
Savory, A. L.
Savory, J. F.
Sharpe, G. Y.
Shephard, T. F.
Shirtliff, W.
Skidmore, J.
Smith, F. C.
Smith, J. T.
Smith, W.
Squire, A. H.
Squire, P.
Squire, P. W.
Squire, W.
Stevenson, W. L.
Storey, E. H.
Stuart, J. E.
Taylor, J.
Thorn, J. J.
Tily, C. A.
Titley, T.
Trotman, A. C.
Tucker, R. L.
Verity, R.
Vœlcker, A.
Watts, J.
Watts, W.
Waugh, H.
Webb, E. A.
Wells, T.
Weston, S. J.
Westrup, J.
Wilkinson, T.
Williams, J. J.
Williams, W. H.
Wooster, J. R.
Wright, C. R. A.
Wyles, W.
Young, W.

London, W.C.
Akhurst, W. E
Attfield, J.
Bannister, R.
Bentley, R.
Bletsoe, J.
Bremridge, R.
Buckle, C. F.
Challice, W. G. W
Cocks, J. L.
Cooper, H.
Davenport, H.
Davenport, J. T.
Fewtrell, W. T.
Gerrard, A. W.
Hake, H. W.
Hogg, J.
Holmes, E. M.
Huggins, R.
Huskisson, H. O.
Lamplough, H.
Law, A.
Mackey, J. B.
McCulloch, F.
Morson, T.
Moss, J.
Passmore, F.
Paul, B. H.
Pedler, A.
Pugh, G.
Redwood, T.
Rich, S. W.
Sainsbury, S.
Senier, A.
Stacey, S. Ll.
Starkie, R. S.
Stevens, F.
Stiles, M. H.
Stoker, G. N.
Taubman, R.
Taylor, C. W.
Thomas, H.
Turner, C. E.
Veitch, W.
Willmott, W.
Wright, A.
Yarde, G.

Long Sutton.
Sutterby, J. N.

Longton.
Prince, A. G.

Lostwithiel.
Kemble, J.

Louth.
Greenwood, J. T

*Hurst, J. B.
Simpson, H. D.

Lower Broughton.
Clarke, J. T.

Lowestoft.
Collins, T. R.
Farrett, W. B
Pearse, W. F.
Rayson, A. J.
Wright, A.

Ludlow.
Nickson, J.

Luton.
Wootton, P.

Lydd.
Nowers, E. A.

Lymm, Cheshire.
Evans, I. H.

Lynn, Norfolk.
*Atmore, G.
Cocher, J. A.

Lytham.
Bannerman, C. A.
Crozier, R.
Fletcher, T.

Macclesfield.
*Bates, W. J.
Hodkinson, J.
Wood, R.

Macduff.
Cruickshank, J.

Machynlleth.
Thomas, J.

Maidenhead.
Thompson, C. H.
Walton, R.

Maidstone.
Brown, R. D.

Malvern Wells.
Bladon, W. G.
Johnson, T. S.
Morgan, W. J.
Wakefield, C. H.

Manchester.
Benger, F. B.
Blyton, J.
Boor, F.
Booth, W. G.
Botham, J.
Bowden, W.
(Patricroft.)
Brown, J.
Brown, W. S.
Bury, J.
Bushby, T.
Carruthers, R. B.
Carter, W.
Caunt, W, F.
Cooper, F. R.
Dale, J.
Darling, W. H.
Davies, T.
Duncalf, J. M.
Edwards, G.
Estcourt, C.
Gee, S.
Gibbons, T. G.
Gibson, J.
Gill, J.
Gill, J. W.
Guilmette, J. W.
Hall, S.
Hardeman, J.
Hart, J.
Hart, T.
Hilditch, T.
Hinchliffe, F. G. U.
Horne, G.
Hughes, E. G.
Hunt, L.
Jackson, A. H.
Jackson, G.
Jones, J.
Kent, G. F.
Ker, A.
Kerfoot, T.
Lane, W.
Mather, W.
Maunder, R.
Midgeley, C.
Mitchell, J.
Muir, M. M. P.
Mumbray, H. G.
Paine, S.
Palmer, A. N.
Payne, J. B.
Peatson, H. R.
Pidd, A. J.
Pratt, G. W.
Pritchard, J.
Ramsbottom, G.
Ridley, E. H.
Robinson, B.
Savage, J. W.
Schorlemmer, C.
Siebold, L.
Smith, J.
Standring, J.
Sugden, S.
Swinn, C.
Terry, T.
Thomson, W.
Twemlow, R.
Walker, S. J.
Wallwork, J.
(Tildesley.)
Walters, R.
Walton, D.
Wealthall, A.
West, T.
Wheeldon, J.
Wild, F.
Wilkinson, G.
Wilkinson, W.
Wilson, H.
Woodhead, W. H.
Woolley, G. S.
Woolley, H.
Wylde, —

Mansfield.
*Agar, W.
Oldham, J.
Patterson, D. J.

Market Deeping.
Linnell, G.

Market Rasen.
Dixon, H.

Marlborough.
Rowe, P. M.

Marlow.
Seaman, J. S.

Marshfield.
Garland, J. F.

Maryport.
Cockton, J.
Dixon, J.

Matlock Bridge.
Hodgkinson, J. S.

Mayfield.
White, E. A.

Melbourne, Derby.
Earp, J.

Melton-Mowbray.
Wing, G. N.

Merthyr.
Daniel, W. L.
Lewellyn, R.
Lewis, J.
Thomas, R.
While, W. J.

Middlesboro-on-Tees.
Bell, F. R.
Robson, J. C.

Middleton.
Roberts, J.

Middleton, Teesdale.
Vipond, W. D.

Midhurst.
Langridge, T. B.

Mildenhall.
Chifney, G. J.

Milnthorpe.
Fothergill, S.

Minchinhampton.
Simpkins, J.

Mirfield, Yorks.
Crook, C.

Modbury.
Lakeman, N.

Mold.
Barker, R.
Williams, E.

Monaghan.
Whitla, J.

Montrose.
Burrell, G.

Morecambe.
Birkett, J.
Gardner, T.

Mount Sorrel.
Tibbles, J. T.
Tibbles, W.

Mountain Ash.
White, G. H.

Neath.
Hutchins, C.

Needham Market, Suffolk.
Harrington, A.

Nefyn.
Wilson, R. M.

New Barnet.
Field, J. J.

Newcastle-on-Tyne.
Bellerby, M.
Bolam J.
*Brady, A.
Brady, H. B.
Brockett, R. H.
Coates, J. M.
Crozier, W.
Dobson, J.
Downie, H.
Dunn, J.
Frank, J. M.
Harcus, J.
Hume, A.
Ismay, J.
Ismay, J. G.
Jobson, R.
Kirkup, T.
Marreco, A. F.
Martin, N. H.
Mather, J. H.
Owen, W.
Parker, M.
Pattinson, J.
Potts, T.
Proctor, B. S.
Stark, J. S.
Swan, J. W.
Todd, H. T.
Watson, M.
Webster, E. P.
Welch, T.

Newcastle-under-Lyne.
Cartwright, W.
Gould, J.
Poole, J.

Newmarket.
Rogers, A. R.

Newport, I. W.
Millidge, W. H.

Newport, Mon.
Faulkner, H.
Garrett, J.
Paine, C.
Young, J.

Newport Pagnell.
Taylor, T.

Newport, Salop.
Picken, T. W.

Newton Abbot.
Godfrey, F.
Ponsford, J.

Newton Stewart.
MacCreath, J.

Newtown, Montgomeryshire.
Lambert, W. H.

Northallerton.
Fairburn, J.
Pick, R.
Warrior, H.

Northampton.
*Bingley, J.
Dadford, T.
Druce, G. C.
Griffin, T.
Harris, J.
Mayger, W. D.
Mayger, W. J.
Negus, S.
Shipman, J. J.

Northwich.
Clough, J.
Lee, W.

Norwich.
Archbold, G.
Baker, P. C.
Caley, A. J.
Cooke, W.
Corder, O.
Cossey, J.
Eldridge, J. H.
Fitch, R.
Fuller, T. B.
Hayhoe, W.
Hill, A.
Robinson, J.
Smith, J. De Carle
Smith, R. B.
*Sutton, F.
Tice, R.
Watson, J. E. H.

Nottingham.
*Atherton, J. H.
Beardsley, J.
Blankley, W.
Bolton, C. A.
Dadley, E.
Dennis, J. L.
Fitzhugh, R.
Guest, W.
Jackson, R.
Jenkins, J. T.
Manfull, H. J.
Oakland, C.
Oakland, W.

Parker, W. H.
Parr, S.
Rayner, J.
Smith, W.
Warriner, C. W.
Waterall, G. E.
White, F.
Wilford, J.
Williams, W. P.
Wood, W. H.

Nuneaton.
Iliffe, T. P.

Oakham.
Plant, W. E.

Oldham.
*Bagshaw, W.
Berry, T.
Braddock, H.
Firth, W.
Hargraves, H. L.
Hurst, J.
Jackson, J. T.
Jackson, R.
Parkinson, W.
Shepherd, J.

Oldmeldrum, N. B.
Daniel, A.

Ossett.
Moore, R.

Otley.
Pratt, R. M.

Oundle.
Roper, H. E.
Turner, R.

Over Darwen.
Cronshaw, C.

Oxford.
Hitchcock, C. E.
Houghton, T.
Odling, W.
Prior, G. T.
Squire, J.
Thurland, H.

Padiham.
Midgley, F.

Paignton.
Merson, W.

Paisley.
Cullen, T.
McMurray, J.

Patricroft.
Bowden, W.

Peebles.
Morison, G.

Pembroke.
John, D. W.

Pembroke Dock.
Bowling, J.

Penge.
Troke, C.

Penrith.
*Kirkbride, W.
Redfern, T.
Wilson, J.

Pentrarth.
Elias, J. R.

Penzance.
Cornish, H. R.

Perth.
Blair, R. P.
Gowans, J.
Wilson, J.

Peterboro.
Bright, R.
Read, H. H.

Petersfield.
Edgeler, W. B.

Plymouth.
*Balkwill, A. P.
Bond, J. K.
Burdwood, J.
Clark, R. J.
Coker, O. C.
Eliott, S., junr.
Foster, F. H.
Furneaux, W. H.
Hearder, H. P.
Lewin, W.
Luke, R. S.
Moore, W. V.
Reade, O. A.
Turney, S. B.
Waterfall, W.

Pontardulais.
Hinds, H. D.

Pontypridd.
Bassitt, C.

Poole.
Atkins, T. W.
Penney, W.

Portobello.
Fitzgerald, A. H.
Kemp, D.
Nesbit, J.

Portree (I. of Skye).
Mitchell, A.

Portsea.
Spear, G.

Portsmouth.
Lewis, J.

Portsoy.
Clark, J.

Port Talbot.
Evans, E.
(Aberavon.)

Prescott.
Slack, J. K.

Presteigne.
Hughes, W., junr.

Preston.
Bell, J. A.
Brown, W. B.
Frill, W. E.
Hargreaves, M.
Hillidge, G.
Mercer, J.
Smith, W.
Tomlinson, J.
Willan, W.
Worthington, W.
Wright, J. A.

Prestonkirk.
Trotter, J.

Prestwich.
Johnson, F.
Mercer, A.

Queen's Ferry, Flintshire.
Turner, J.

Queenstown.
Houghton, R. W.

Ramsbottom.
Morton, J.

Ramsey.
Palmer, F. W.

Ramsgate.
Balch, E.
Daniel, S.
Fisher, C.
Fisher, H. A.
Franks, A.

Raunds.
Swift, W. P.

Rawtenstall, Lancs.
Halstead, H.
Lord, L.

Reading.
Bailey, J. B.
Bartle, W.
Dowling, R.
Hill, J.
Welch, C.
While, W. J.
Wilson, J. P.

Redcar.
Dowson, J.

Redditch.
Taylor, R.
Wheeler, C.

Redhill.
Padwick, T.
Sillitoe, F. H.

Redruth.
Edwards, R. S.
Rowe, S. T.

Rhyl.
Foulkes, W. H.
Jones, E. P.

Rhynie.
Roger, J. P.

Richmond, Surrey.
Clarke, T. M.
Hopwood, T. S.
Mumbray, R. G.

Richmond, Yorks.
Thompson, L.
Thompson, T.
Walton, G. R.

Riddings, Derby.
Neale, H.
Shaw, A.

Ridgeway.
Archer, A.

Ripley, Derby.
Daykin, K.

Rochdale
Aspinall, J.
Bamford, J. W.
Booth, J.
Hadfield, J.
Lynch, E. B.
Mason, A.
*Robinson, R.
Taylor, E.
Turner, H.

Rochester.
Harris, H. W.

Romsey, Hants.
Francis, G.
Slater, W. H.

Rothbury, Northumberland.
Farrage, R.
Riddell, H. B.

Rotherham.
*Davy, H.
France, J.
Greaves, E. (Mexbro')
Johnson, A.

Rothesay.
Duncan, W.
Macintosh, A.

Rothwell.
Ginns, A. B.

Royston, Herts.
Bull, B.
*Matthews, E.

Ruabon.
Yardley, E.

Rugby.
Garratt, S.

Ruthin.
Rouw, W. T.

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Hull Chemists' Association	Mr. C. B. Bell, Spring Bank, Hull.
Leeds Chemists' Association	Mr. J. W. Longley, 40, Wade Lane, Leeds.
Leicester Chemists' Assistants and Apprentices' Association	Mr. ——, 15, Belvoir Street, Leicester.
Liverpool Chemists' Association	Mr. A. H. Mason, 313, Upper Parliament Street, Liverpool.
Manchester Chemists and Druggists' Association	Mr. F. B. Benger, F.C.S., 7, Exchange Street, Manchester.
Midland Counties Chemists' Association	Mr. S. Dewson, 90, New Street, Birmingham.
Nottingham and Notts Chemists' Association	Mr. Roberts Jackson, 52, Bridlesmith Gate, Nottingham.
North British Branch of the Pharmaceutical Society	Mr. J. Mackay, 119, George Street, Edinburgh.
Oldham Chemists and Druggists' Assistants and Apprentices' Association.	Mr. E. Richards, 30, High Street, Oldham.
Sheffield Pharmaceutical and Chemical Association	Mr. H. W. Maleham, 7, Westbar, Sheffield.
Sunderland Chemists' Association	Mr. J. J. Nicholson, 226, High Street West, Sunderland.
Wolverhampton Chemists and Druggists' Association.	Mr. W. Y. Brevitt, Darlington Street, Wolverhampton.
Yorkshire College of Science	Mr. R. Reynolds, 13, Briggate, Leeds.

The following Journals are sent by their respective Editors in exchange for the YEAR-BOOK OF PHARMACY.

Archiv der Pharmacie, from Professor E. REICHARDT, Jena.
American Journal of Pharmacy.
The British Medical Journal.
The Chemical News.
The Chemist and Druggist, from the PUBLISHER.
The Pharmaceutical Journal, from the PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.
Journal de Pharmacie d'Anvers, from M. VAN PELT, Marché aux Bœufs, 27, Antwerp.
Journal de Pharmacie et de Chimie, from M. G. MASSON, 17, Place de l'Ecole de Médicine, Paris.
Neues Repertorium für Pharmacie, from Dr. L. A. BUCHNER, München.
Pharmaceutische Centralhalle, from Dr. HERMANN HAGER, Pulver Mühle bei Fürstenberg-on-Oder.
New Remedies, from FREDK. A. CASTLE, M.D., New York.
The Pharmacist.

PROGRAMME OF THE PROCEEDINGS

OF THE

BRITISH PHARMACEUTICAL CONFERENCE,

AT THE

FOURTEENTH ANNUAL MEETING, PLYMOUTH, 1877.

OFFICERS:

President.

PROFESSOR THEOPHILUS REDWOOD, PH.D., F.C.S., LONDON.

Vice-Presidents.

Who have filled the office of President.

PROF. BENTLEY, F.L.S., M.R.C.S., London.
W. W. STODDART, F.C.S., F.G.S., Bristol.
H. B. BRADY, F.R.S., Newcastle-on-Tyne.
THOMAS B. GROVES, F.C.S., Weymouth.

Vice-Presidents.

A. P. BALKWILL, Plymouth.
R. REYNOLDS, F.C.S., Leeds.
T. H. HILLS, F.C.S., London.
J. WILLIAMS, F.C.S., London.

Treasurer.

G. F. SCHACHT, F.C.S., Clifton, Bristol.

General Secretaries.

PROF. ATTFIELD, PH.D., F.C.S., 17, Bloomsbury Square, London, W.C.
F. BADEN BENGER, F.C.S., 7, Exchange Street, Manchester.

Assistant Secretary.

R. H. DAVIES, F.C.S.

Local Secretary.

R. J. CLARK, Plymouth.

Editor of the Year-Book.

LOUIS SIEBOLD, F.C.S.

Editor of the Transactions.

PROF. ATTFIELD, PH.D., F.C.S.

Other Members of the Executive Committee, 1876-7.

M. CARTEIGHE, F.C.S., London.
C. EKIN, F.C.S., Bath.
W. A. TILDEN, D.Sc. F.C.S., Clifton.
C. UMNEY, F.C.S., London.
F. CODD, Devonport.
D. FRAZER, Glasgow.
A. KINNINMONT, Glasgow.
B. S. PROCTOR, Newcastle-on-Tyne.
E. SMITH, F.C.S., Torquay.

Auditors.

T. DAVISON, Glasgow.
S. B. TURNEY, Plymouth.

Local Committee for Plymouth.

CODD, F., *Chairman.*
ELIOTT, S., *Treasurer.*
SKINNER, K. G. W. } Secs.
CLARKE, R. J. } Secs.
ALLEN, J.
BALKWILL, A. P.
BARGE, J.
BREEZE, G.
BURDWOOD, J.
COKER, O. C.
DAYMOND, S.
DOBLE, H. T.
DOWN, W.
DYER, W.
EYRE, J. S.
FOSTER, J. H.
GELDARD, J.
GUYER, J. B.
HEARDER, W.
HEARDER, H. P.
KEEN, B.
LAKEMAN, N.
MAITLAND, P. C.
NETTEN, H. T.
PERCY, T. B.
PROCKTER, J.
RICHES, T.
ROWE, S. T.
SMITH, E.
TURNEY, S. B.
WEARING, J.
WOODS, W.
YOUNG, R.

THE SITTINGS OF THE CONFERENCE WERE HELD AT

THE ATHENÆUM, GEORGE STREET, PLYMOUTH,
ON TUESDAY AND WEDNESDAY, AUGUST 14TH AND 15TH, 1877.
Commencing at Ten a.m. each day.

MONDAY, August 13th.

The EXECUTIVE COMMITTEE met, according to notices from the Secretaries, at 8.0. p.m. at the Athenæum, George Street.

TUESDAY, August 14th.

The CONFERENCE met at 10 o'clock a.m., adjourning at 12.30 p.m.; and at 2 o'clock p.m., adjourning at 4.30 p.m.

Order of Business:

Reception of Delegates.
Report of Executive Committee.
Financial Statement.
Report of Treasurer of the "Bell and Hills" Library Fund.
Presentation of the "Bell and Hills" and "Hanbury" books by the Conference, to the Local Association.
President's Address.
Reading of Papers and Discussions thereon.

PAPERS.

1. *Report of the Committee on the Extraction and Investigation of the Aconitines of Aconitum Napellus.* Dr. WRIGHT, F.C.S., J. WILLIAMS, F.C.S., and T. B. GROVES, F.C.S.
2. *The Alkaloids of Japanese Aconite.* Dr. PAUL, F.C.S., and C. T. KINGZETT, F.C.S.
3. *Report on the Active Principle of Cayenne Pepper.* J. C. THRESH, F.C.S.
4. *Report of Continued Researches on Essential Oils.* Dr. TILDEN, F.C.S.
5. *Report of a Research* (Part II.) *on Essential Oil of Sage.* M. M. P. MUIR, F.C.S., and Mr. SIGUIRA.
6. *Report on the Proximate Constituents of Ivy Berries..* R. H. DAVIES, F.C.S.
7. *Note on Hederic Acid.* C. T. KINGZETT, F.C.S.
8. *The Supply of Cinchona Bark as connected with the Price of Quinine.* JOHN ELIOT HOWARD, F.R.S.
9. *An Impurity in Oxide of Zinc.* W. W. STODDART, F.C.S.
10. *Additional Notes on the Assay of Opium.* Mr. B. S. PROCTOR.
11. *Sugar in Pharmacy.* Dr. C. SYMES.
12. *Proximate Principles of Narcissus [Pseudo-narcissus.* Mr. A. W. GERRARD.

Between 12.30 and 2 o'clock the ladies and gentlemen attending the Meeting, on invitation of the Local Committee, partook of Luncheon in the Mechanics' Institute, Princess Square.

WEDNESDAY, August 15th.

The EXECUTIVE COMMITTEE met at 9.30 a.m. in the Athenæum.

The CONFERENCE met at 10 o'clock a.m., adjourning at 12.30 p.m.; and at 2 o'clock p.m., adjourning at 4.30 p.m.

Order of Business:

Reception of Delegates.

Reading of Papers and Discussions thereon.

PAPERS.

13. *A Glance at the Materia Medica of Devon.* E. Smith, F.C.S.
14. *Some Experiences in the Equipment and Working of a Small Pharmaceutical Laboratory.* G. F. Schacht, F.C.S.
15. *Note on Di-phenylamine as a Test for Nitric and Nitrous Acids.* Mr. N. H. Martin.
16. *The Pill Masses of the B. P. which are of Inconvenient Consistence or acquire that Consistence by Keeping.* J. C. Thresh, F.C.S.
17. *On a Product of the Oxidation of Barbaloin and Socaloin.* Dr. Tilden, F.C.S.
18. *A Point in Pharmaceutical Ethics.* Mr. S. R. Atkins.
19. *Preserved Foods and Copper.* Dr. Paul, F.C.S., and C. T. Kingzett, F.C.S.
20. *Analyses of Preserved Carrots, Potatoes, Cabbage, and Mixed Vegetables.* Professor Attfield.
21. *Scammony Root.* C. T. Kingzett, F.C.S.
22. *Further Note on the History of Tea Hair.* Thomas Greenish, F.C.S.
23. *Copaiba Testing.* Louis Siebold, F.C.S.
24. *A New Medicinal Solution of Phosphorus.* Mr. W. W. Urwick.
25. *Blood Albumen.* C. T. Kingzett, F.C.S.
26. *Note on Pilocarpine.* C. T. Kingzett, F.C.S.
27. *Tincture of Acetate of Iron.* Dr. C. R. C. Tichborne, F.C.S.
28. *Effects of Variations of Temperature on Boiled Putrescible Liquids.* Mr. W. Willmott.

Place of Meeting for 1878.

Election of Officers for 1877–1878.

Between 12.30 and 2 o'clock the ladies and gentlemen attending the Meeting, on invitation of the Local Committee, partook of Luncheon in the Mechanics' Institute, Princess Square.

THURSDAY, August 16th.

The Members of the Conference, invited by the Local Committee of the Pharmacists of Devon and Cornwall, went for an enjoyable steamboat excursion across the harbour and up the rivers Tamar and Plym.

BRITISH PHARMACEUTICAL CONFERENCE.

MEETING IN PLYMOUTH, 1877.

The fourteenth annual meeting of the British Pharmaceutical Conference commenced on Monday, August 13, in the Athenæum, George Street, Plymouth, under the presidency of Professor Theophilus Redwood, Ph.D., F.C.S.

The following gentlemen were present at the sittings of the Conference.—A. H. Allen (Sheffield), J. Allen (Plymouth), J. Arnold (Guernsey), S. R. Atkins (Salisbury), J. Attfield (London), A. P. Balkwill (Plymouth), J. Barge (Plymouth), B. J. Barron (Plymouth), W. Barron (Cheltenham), F. B. Benger (Manchester), G. Bennett (London), W. Berry (Clifton), W. J. Binder (Barnsley), J. Booth (Rochdale), G. Breeze (Devonport), E. Bremridge (London), F. Bullock (Anerley), J. Burdwood (Plymouth), J. D. Burton (London), W. N. Curveth (Plymouth), C. T. W. Cary (Plymouth), G. Chaloner (London), R. Chipperfield (Southampton), R. J. Clark (Plymouth). J. W. Cocks (Torquay), O. C. Coker (Plymouth), J. C. Coles (Chippenham), A. T. Collier (Plymouth), G. H. Cottrill (Shepton Mallet), C. Cracknell (London), R. H. Davies (London), T. Davison (Glasgow), S. Daymond (Stonehouse), S. Dewson (Birmingham), F. P. Dickerson (Plymouth), R. H. Down (Torpoint), S. Eliott (Plymouth), C. Ekin (Bath), W. Fleeming (Wolverhampton), D. Frazer (Glasgow), E. G. Foot (Plymouth), F. H. Foster (Plymouth), J. B. Foster (Plymouth), E. Friend (Torquay), A. W. Gerrard (London) T. G. Gibbons (Manchester), T. Greenish (London), T. B. Groves (Weymouth), J. B. Guyer (Torquay), T. Hall (Liverpool), T. S. M. Hall (Liverpool), R. M. Hatch (Clifton), F. J. Hawking (Plymouth), F. Hawkins (Plymouth), H. P. Hearder (Plymouth), H. T. Hearder (Plymouth), T. Hearder (Torquay), W. Hills (London), A. Hunt (Exeter), P. Jefferson (Leeds), R. P. Jefferson (Leeds), W. J. Jenkin (Plymouth), H. C. Jones (London), J. Kemble (Lostwithiel), J. Kershaw (Southport), W. H. T. King (Plymouth), J. M. Kingdom (Holsworthy), C. T. Kingzett (London), N. Lakeman (Modbury), T. Lister (Barnsley), W. Lister (Barnsley), R. S. Luke (Plymouth), S. Macadam (Edinburgh), F. Maitland (Stonehouse), P. C. Maitland (Stonehouse), S. Maitland (Stonehouse), G. Manby (Southampton), H. C. Marsh (Plymouth), N. H.

Martin (Newcastle-on-Tyne), J. Mitchell (Plymouth), W. V. Moore (Plymouth), T. P. Morson (London), J. Moss (London), J. G. Netting (Plymouth), S. Nicholls (Plymouth), E. A. Opie (Plymouth), J. Owen (London), R. Oxland (Plymouth), F. Passmore (London), B. H. Paul (London), J. C. C. Payne (Belfast), S. Plowman (London), W. J. Rawlings (Devonport), T. Redwood (London), S. Riches (Torquay), J. Robbins (London), S. T. Rowe (Redruth), R. A. Saunders (Mutley), W. D. Savage (Brighton), H. Sayer (Torquay), G. F. Schacht (Clifton), C. Shapley (Torquay), L. Siebold (Manchester), R. W. Silson (Bradford), K. G. W. Skinner (Plymouth), F. Slinger (York), E. Smith (Torquay), J. E. Southall (Leominster), F. J. C. Squire (St. Austell), H. G. Stacey (London), E. J. Stansby (Stonehouse), W. B. Stephens (Plymouth), R. H. Swingburn (South Molton), C. Symes (Liverpool), L. Tait (Birmingham), W. C. Taylor (Bombay), W. Thomson (Manchester), J. D. Turney (Plymouth), S. B. Turney (Plymouth), C. Umney (London), J. F. Walker (York), R. Weatherley (London), J. Williams (London), S. R. Williams (Devonport), W. H. Williams (Plymouth), W. Willmott (London), G. Windsor (Torpoint), A. C. Wootton (London), E. Worth (Bournemouth), C. R. A. Wright (London), T. Wright (London).

Meeting of the Executive Committee.

On Monday Evening, a meeting of the Executive Committee was held. Present—Professor Redwood, *President;* Messrs. Groves, Balkwill, and Williams, *Vice-Presidents;* Mr. Schacht, *Treasurer;* Professor Attfield and Mr. Benger, *Hon. Gen. Secs;* Mr. Clarke, *Local Sec.*, and Messrs. Ekin, Codd, E. Smith, and Umney.

Professor Attfield reported that between 400 and 500 members out of their 2550 still owed their subscription for the year ending June 30, 1877, and that to each of these gentlemen applications for the 7*s.* 6*d.* had five times been posted.

The Secretaries further reported that during the year a copy of the usual list of subjects for research had been sent to each member; that a copy of the *Year-Book* had been delivered free to every member who had previously paid his subscription; and that the usual annual circulars relating to the meeting at Plymouth had been duly distributed to all members.

Professor Attfield stated that about one hundred members of the Conference had been directly asked to contribute the results of original investigation, etc., to the annual meeting. Thirty-two papers had been promised, four promises had been withdrawn, and the remaining twenty-eight papers were offered for acceptance.

Mr. BENGER offered a draft report of the Executive Committee, which was unanimously accepted.

The Financial Statement for the year 1876–77 was handed in by the Treasurer.

Respecting the Bell and Hills Library Fund, Professor Attfield said he had corresponded with the officers of the Local Pharmaceutical Association at Plymouth, and that the books selected he had purchased, and had bound, and had brought them to Plymouth for presentation at the general meeting of the members; as well as portraits of Jacob Bell and William Allen, presented by Mr. Hills.

Professor ATTFIELD said he had received from Messrs. Macmillan & Co., by direction of Mr. Thos. Hanbury, thirty copies of "Pharmacographia" and thirty copies of "Science Papers," with a letter from Mr. Thos. Hanbury to the President of the Conference as follows:—

"These books I desire to present in memory of my late brother, Daniel Hanbury, F.R.S., through the British Pharmaceutical Conference, to the Provincial Pharmaceutical Associations of the towns at which the Conference has already met, and where it will assemble during the next few years."

The Secretaries were ordered to present one copy of each to the Local Association at Plymouth at the time that the Bell and Hills books were presented at the General Conference Meeting on the following day, and to offer one copy of each work to the library of the Pharmaceutical Association of each town at which the Conference had already held its meetings.

In answer to Mr. Clarke, Professor Attfield said that the deficit in the receipts as compared with last year was partly due to loss of members, but mainly because the late publication of the *Year-Book* had prevented the collection of advertisement accounts before the end of the Conference year. The amount still owing from advertisers in the current *Year-Book* would swell the receipts next year.

Mr. Schacht raised a discussion respecting the nature of the securities in which the Bell and Hills Funds were invested. After most of the members had expressed their opinions, the following resolution was moved by Mr. Ekin, seconded by Mr. E. Smith, and carried *nem. con.*:—"That the Russian bonds in which the Bell and Hills Fund is invested be sold, and the proceeds re-invested in Consols." Mr. J. Williams then proposed the next resolution, which was seconded by Mr. C. Umney, and carried unanimously:—"That the Treasurer transfer from the General Fund to the Bell and Hills Fund such a sum as may be necessary to allow of that fund yielding, when invested in Consols, a clear ten pounds annually."

Respecting the best mode of profiting by the Bell and Hills Fund Books a discussion ensued, in which Messrs. Balkwill, Clarke, Groves, Schacht, Attfield, and Williams joined.

Professor ATTFIELD submitted a proof of a programme of proceeding at the ensuing meeting, which he had drawn up and had put into type to save the time of the Committee. With a few alterations in the order of the papers, this programme was accepted. Papers by two gentlemen were considered by the Committee, and instructions given to the Secretaries to ask the authors to withdraw them, on the ground of unfitness to the objects of the Conference. Respecting a paper on "A Point in Pharmaceutical Ethics," by Mr. Atkins, a member of the Committee, Mr. Groves, was requested to communicate with the author, with a view to preventing any consideration or discussion trenching on pharmaceutical politics.

The consideration of a list of officers for 1877–8, to be recommended to the members for election, was commenced and postponed.

ADJOURNED MEETING.

Tuesday, August 14, 1877.

Present—Professor Redwood, Messrs. Attfield, Benger, Schacht, Umney, Ekin, Smith, Groves, and Williams.

The following resolution was passed unanimously:—"That Dublin be recommended to the members as the place of meeting in 1878."

The list of officers for 1877–8 was drawn up for recommendation to the members.

Year-Book, 1877.—Professor Attfield said he had received from the editor what the latter stated was the complete MS. of the *Year-Book* for 1877, except that the introduction was wanting. The appointment of editor for the 1878 *Year-Book* was postponed.

Grants.—Mr. Shenstone applied for £5 to aid in an examination of the alkaloids of false angostura bark. The sum was at once voted. A sum of £20 was then voted to the Committee appointed to investigate the aconitines. Mr. M. M. P. Muir applied for £20 with which to continue his researches on oil of sage. The Committee, after some consideration, concluded that as this research, though apparently of much abstract chemical value, gave but slight promise of pharmaceutical interest, it was scarcely a fit subject for support by a grant from a pharmaceutical association.

GENERAL MEETING.

Tuesday, August 14th.

RECEPTION OF DELEGATES.

Mr. CODD, on behalf of the local pharmacists, having welcomed the Conference to Plymouth,

The PRESIDENT called on Professor Attfield, General Secretary, to read the names of delegates present.

Professor ATTFIELD expressed his pleasure in finding that this year not only every provincial association connected with pharmacy was represented there, but also each of the Pharmaceutical Societies, for there were now more than one; especially the Pharmaceutical Society of Great Britain had sent several delegates. The delegates present were as follows:—

Pharmaceutical Society of Great Britain.—The President (Mr. Williams), Messrs. Atkins, Cracknell, Greenish, Owen, Robbins, Savage, and Schacht.

Pharmaceutical Society of Ireland.—Messrs. J. C. C. Payne and C. R. C. Tichborne.

Midland Counties Chemists' Association.—Mr. Stokes Dewson.

Bristol Pharmaceutical Association.—Mr. Schacht.

Exeter Pharmaceutical Association.—Messrs. G. Delves and G. Pasmore.

Glasgow Chemists' Association.—Messrs. Davison and Frazer.

Leeds Chemists' Association.—Mr. Peter Jefferson.

Liverpool Chemists' Association.—Dr. Symes.

Manchester Chemists' Association.—Messrs. Benger and Siebold.

Wolverhampton and District Chemists and Druggists' Association.—Mr. Fleeming.

Mr. F. B. BENGER, F.C.S., General Secretary, read letters from Mr. Brady, Newcastle, and Mr. Reynolds, Leeds, expressive of their regret at not being able to be present.

Mr. BENGER then read the report of the Executive Committee as follows:—

REPORT OF THE EXECUTIVE COMMITTEE.

"In presenting their Fourteenth Annual Report, the Executive Committee again avail themselves of the opportunity of congratulating the members of the British Pharmaceutical Conference on the continued prosperity and usefulness of the Association.

"The work of your Committee during the past year presents no special features. The collection of members' subscriptions, the publication of the *Year-Book,* and the issue of the usual lists of proposed subjects for research, and of circulars having reference to the present meeting, are the chief items which have occupied their attention.

"It will be seen from the balance sheet to be presented by the Treasurer, that practically the whole of the income of the Conference has this year been devoted to the advancement of scientific pharmacy. Your Committee believe that such a disposal of the funds is in strict accordance with the intention of the founders of this association, and with the wishes of present members; and they may be excused for looking with some pride, as well as much satisfaction, to the important services which the Conference is now, year by year, rendering to pharmacy proper, and therefore to the practice of medicine, and to the sanitary interests of the community. These results are being achieved, first, by the character and amount of the original matter directly communicated to the Conference by the authors of papers read at its annual meetings, and evolved during the discussion of such papers by the members present.

"Then, secondly, by the substantial grants of money which your Committee have been able to make to gentlemen undertaking special costly researches connected with pharmacy, original work of the highest importance is being promoted, and discoveries are made which will have interest and value wherever medicine and pharmacy are practised; whilst the investigation of difficult and complicated problems, such as that undertaken by Messrs. Groves, Williams, and Wright, on the aconite alkaloids, is of great scientific and probable practical importance; moreover, they are scarcely likely to be undertaken by individuals at their own expense, and are on that account the more suitable subjects to be investigated at the partial cost of the Conference.

"Thirdly, by the production and distribution of the now well-known *Year-Book of Pharmacy*.

"Fourthly, by the pleasant and profitable friendly intercourse brought about amongst the widely scattered pharmacists who assemble at our annual meetings.

"The papers sent in to the Secretaries to be read at the present meeting are of great and varied interest, and sufficiently numerous to fully occupy the two days devoted to their reading and discussion.

"A number of applications for grants in aid of research were received and considered during the Glasgow meeting.

"The following amounts have been drawn during the year by members to whom such grants were voted, and reports on the various subjects will be presented:—Mr. J. C. Thresh, F.C.S., for the purchase of materials in connection with an extended research on the active principle of capsicum fruit, £7; Dr. Tilden, F.C.S., for the purchase of essential oils required in a research, £20; Mr. T. B. Groves, F.C.S., Mr. J. Williams, F.C.S., and Dr. C. R. A. Wright, F.C.S., for the extraction and investigation of the aconitines of *Aconitum Napellus*, £30; Mr. M. M. P. Muir, F.C.S., for a second research on oil of sage, £3.

"The salary of the Editor of the *Year-Book* has been advanced from £100 to £150 per annum.

"It was at the Exeter meeting of the Conference in 1869 that the Sub-Committee appointed to consider the desirability of publishing a *Year-Book of Pharmacy* presented their report; and on the motion of Messrs. Palk and Cooper that the recommendation was adopted. At that date the Conference numbered less than 700 members. After an absence of eight years the Conference has returned to Devonshire. Its membership roll now contains between 2000 and 3000 names, and the *Year-Book* occupies a deservedly high position amongst the publications of the year, and is, as it was intended to be, the familiar desk companion of the pharmacist.

"It may be remembered that the MS. of the 1876 volume was laid on the table by the editor at the last annual meeting: its issue was, however, unavoidably delayed by circumstances beyond the control of the Committee, mainly in consequence of the illness of the editor, and the great pressure on his time caused by accumulated work and engagements. Some loss of members has doubtless been caused to the Conference by this unfortunate circumstance, but your Committee confidently hope that the forthcoming volume will be in the hands of the members before the end of the year. The MS. is now complete, with the exception of the introduction, and the editor, having made arrangements which relieve him of all business engagements, is able to devote his whole time to literary and professional work; your Committee have felt it to be due to the members to make this statement, as much disappointment has been felt by those who were unacquainted or only partially acquainted with the circumstances of the case.

"At a meeting of your Committee held last evening, Professor Attfield placed on the table, with the usual eighteen guineas' worth of books from the Bell and Hills Library Fund, copies of Hanbury's "Pharmacographia" and "Science Papers," stating that Mr. Thomas Hanbury desired to present a copy of each of these works in memory of his brother, the late D. Hanbury, F.R.S., to the local associations in towns visited by the Conference.

"In conclusion, your Committee would urge members to bring the

Conference under the notice of as many of their pharmaceutical friends as possible: the mere mention of the objects aimed at by the Conference, the advantages derived from membership, the intrinsic value of the *Year-Book* and the smallness of the annual subscription, are generally sufficient to ensure a willingness to be nominated for election. It should be borne in mind that the Conference must of necessity lose yearly many members from various causes; and that merely to maintain its present strength a considerable number of new names must be added annually."

Mr. G. F. Schacht, Treasurer, read the financial statements:—

The General Fund.

The Senior Hon. Secretary in Account with the British Pharmaceutical Conference, for the year ending June 30, 1877.

1876–77. *Dr.*	£	*s.*	*d.*
To Sale of *Year-Books* by Secretary	15	0	0
,, ,, ,, Publishers	27	8	4
,, Advertisements in 1875 vol.	8	15	6
,, ,, 1876 vol.	101	6	6
,, Subscriptions from Members	771	7	4
	£923	17	8

1876–77. *Cr.*				£	*s.*	*d.*
By Expenses connected with *Year-Book*:—						
Butler & Tanner for printing, binding, and banding	£438	19	1			
Editor's Salary	150	0	0			
Messrs. Churchill—commission on advertisements	27	10	6			
Advertising *Year-Book*	2	12	0			
Delivery to Members	73	0	7			
Foreign Journals (Nutt)	6	12	2			
,, ,, (Skeet)	1	1	0	699	15	4
,, General Printing:—						
Butler & Tanner	17	4	4			
Stevens & Richardson	8	4	0			
Parkins & Gotto	2	5	4	27	13	8
,, Directing Circulars and Envelopes				6	12	9
,, Assistant Secretary's Salary				40	0	0
,, Postage (about 12,000 letters)				48	1	4
,, Sundries				8	15	2
,, Expenses of Meeting at Glasgow				24	9	4
,, Grants in Aid of Research				60	0	0
,, Balance paid to Treasurer				8	10	1
				£923	17	8

The Hon. Treasurer in Account with the British Pharmaceutical Conference, for the year ending June 30, 1877.

1876. *Dr.*	£	*s.*	*d.*
To Balance in hand on July 1, 1876	241	16	4
July 10. To Dividend on £200 3 per cent. Consols	2	19	3
1877			
Jan. 10. To Dividend on £400 3 per cent. Consols	5	18	6
June 30. To Balance of General Fund, 1876–77, received from Dr. Attfield	8	10	1
	£259	4	2

1876. *Cr.*	£	*s.*	*d.*
Aug. By Purchase of £200 3 per cent. Consols at $96\frac{3}{8}$, and Brokerage 5*s.*	193	15	0
,, Balance in hand	65	9	2
	£259	4	2

		£	*s.*	*d.*
Assets, July 1, 1877	Cash in hand	65	9	2
	Consols (stock)	400	0	0

On the motion of the President, the report and accounts were received and adopted.

The Bell and Hills Fund.

The Treasurer then read the statement with regard to the Bell and Hills Library Fund.

The Bell and Hills Library Fund.

1876–77. *Dr.*	£	*s.*	*d.*
To Balance in hand on July 1, 1876	5	18	8
Sept. 1. To Dividends from four £50 Russian Bonds	4	17	9
March 1. ,, ,, ,, ,, ,,	4	18	3
	£15	14	1

1877. *Cr.*	£	*s.*	*d.*
June. By Dr. Attfield for Purchase of Books for Plymouth	10	10	0
,, Balance in hand	5	4	1
	£15	14	1

		£	*s.*	*d.*
Assets, July 1, 1877.	Cash in hand	5	4	1
	Russian Bonds (stock)	200	0	0

Examined and found correct,
T. Davison, Glasgow,
S. B. Turney, Plymouth,
Auditors.

The PRESIDENT suggested that the thanks of the Conference be presented to Mr. Thomas Hanbury for the gift of books referred to in the report, which was unanimously agreed to.

Professor ATTFIELD said he had next to announce that Mr. T. H. Hills, in addition to the books already alluded to, had commissioned him to present to the local association two portraits of eminent pharmacists, viz., the first President of the Pharmaceutical Society, Mr. William Allen, and the chief founder of that Society, Mr. Jacob Bell. He hoped these portraits would be placed in the room which would hereafter become the library of the Association.

Mr. R. J. CLARK (Local Secretary) moved a vote of thanks to Mr. Hills, and said he hoped the books now presented would form the nucleus of a library which should be extensively used by the young men engaged in the practice of pharmacy.

The motion was seconded and carried unanimously.

The PRESIDENT next delivered the following address:—

THE PRESIDENT'S ADDRESS.

GENTLEMEN,—As you have done me the honour of placing me again in the President's chair, it becomes my duty to address you at this stage of our proceedings, and I think I cannot more appropriately commence my address than by referring to the satisfactory evidences of the continued prosperity of our association, which are afforded us in the reports which have been read relating to the past year, in the prospect we have of much good matter for the present meeting, and in the indications we receive from various quarters of a desire to co-operate with us in furthering the objects for which we have met here in conference.

One of the objects we desire to promote by these meetings is that of effecting a union of pharmacists for scientific purposes on the broadest basis, and of bringing into close and friendly intercourse not only the scattered members of the body we represent, but those of other associations and of every nationality, who have a common interest with us in the advancement of the art of pharmacy. We are endeavouring to effect such advancement by an extension of pharmacological studies and researches among those with whom we are associated, and by encouraging the cultivation of the knowledge which will best enable the druggist to fulfil the duties which the requirements of the public and the medical profession impose upon him. The means which are adopted by this and other kindred associations for effecting these important objects, if they be pursued in unison with each other, as I believe they are being, and are likely to be, cannot fail to produce results that will tend to place the practice of pharmacy in the honourable position it deserves to occupy. If at times any of our friends should be ready to falter in their progress, and to fear that we are pursuing a course which may lead them away from the few substantial advantages they possess into the utopian regions of empty honour, it behoves us to hold out the hand of encouragement, and to endeavour to demonstrate to them that the profit and the honour resulting from our professional occupations will mainly depend on the value of the services we are enabled to render to those who have pressing need of them, and the completeness of the qualifications we possess for the efficient performance of all we undertake to do. The position in which we as pharmacists are placed in the present day is very different from that which our predecessors, the druggists of a century and a half ago, occupied. The druggist of the 17th century has become an extinct species, while the druggist of to-day has been transformed into the apothecary of the 17th century. In the transitions which have thus taken place we may find matter from which to derive profitable instruction. We may also learn from a retrospect of our past history, that there has always been in this country an indisposition to legislate in reference to the practice of medicine until the public wants have developed the means of providing what is required and best suited to supply them.

The early history of the practice of medicine in this country is involved in some obscurity, but it appears that both medicine and pharmacy were formerly often associated with the ecclesiastical profession; and that surgery, being of too sanguinary a character to admit of such an association, formed a more natural alliance with the occupation of the barbers.

Medicine, but not surgery, was studied at our universities; but there was no law to define the qualifications of a physician or to regulate the practice of medicine.

Before legislation commenced on these subjects, the surgeons took the lead of the physicians in obtaining recognition from the Government.

About the middle of the 15th century a charter of incorporation was granted by Edward IV. to the company of barber surgeons, who were invested with authority to examine the instruments and remedies employed, and to bring actions against those who practised illegally and ignorantly, none being allowed to practise who had not been previously admitted and judged competent by the master of the company.

An attempt to legislate for the purpose of regulating the practice of medicine had been made as far back as the year 1422, at the instigation of the universities of Oxford and Cambridge, where degrees in physic were granted to those who had studied for the profession; but although an Act passed through Parliament in that year to the effect that "no one shall use the mystery of physic unless he hath studied it in some university, and is at least a bachelor in that science," this Act appears not to have come into operation, for having been referred to the Privy Council for confirmation, it was there allowed to drop.

The first successful attempt at legislation was made in 1511, when a law was passed which imposed upon physicians and surgeons practising as such in and around London, and also in the provinces, the necessity of passing an examination, and being approved and admitted, by a body of examiners consisting of the bishop or some other dignitary of the Church, with four members of the faculty of medicine.

The College of Physicians was established by Royal Charter in 1518, and four years afterwards, in 1522, a law was passed by which the examination of those allowed to practise as physicians was transferred to the college from the body previously entrusted with the performance of this duty.

Independently of the barber-surgeons, there was but one class of recognised medical men, namely, the physicians, who prepared and dispensed the medicines they prescribed. The only class of men who at that time could be properly called apothecaries were the assistants employed by the physicians to perpare their medicines. Some of these assistants from time to time, no doubt, started on their own account, and probably occupied an equivocal position either as doctors or dealers in medicines, for until the year 1511 there had been no law to define the qualifications of a physician, and at that period, and for many years afterwards, there is no evidence of the existence in this country of a body of men engaged on their own account as dispensers of medicines. This indeed would necessarily have resulted from the fact that physicians were not then in the habit of writing prescriptions for their patients. The first notice we find of apothecaries engaged in business as such, and probably these were only dealers in compounded medicines, is in the middle of the 16th century, when the College of Physicians acquired the power of searching apothecaries' shops, examining their medicines, and destroying such as were found to be unfit for use.

It appears that about this time the surgeons were considered to have exercised the power that had been given them of restricting the practice of their profession to members admitted by their company, too strictly, and without sufficient regard to the requirements of the poor. An Act of toleration was therefore passed in 1542, which set forth that "the Company and Fellowship of Surgeons of London, minding onely their oune lucres, and nothing the profit or ease of the diseased or patient, have sued, troubled, and vexed divers honest persons, as well men as women, whom God hath endued with the knowledge of the nature, kind, and operation of certain herbs, roots, and waters, and the using and ministering of them to such as have been pained with customable diseases, as women's breasts being sore, a pin and the web in the eye, uncomes of the hands, scaldings, burnings, sore mouths, the stone, stranguery, saucelin and morphem, and such other like diseases. . . . And yet the said persons have not taken anything for their pains and cunning. . . . In consideration whereof, and for the ease, comfort, succour, help, relief, and health of the King's poor subjects, inhabitants of this his realm, now pained or diseased, be it ordained, etc., that at all time from henceforth it shall be lawful to every person, being the king's subject, having knowledge and experience of the nature of herbs, roots, and waters, etc., to use and minister them according to their cunning, experience, and knowledge . . . the aforesaid statute (the Act of 1511) or any other Act notwithstanding."

This Act was intended for the relief and toleration of those who, although not legally qualified medical men, yet possessing some knowledge of medicines, administered them gratuitously. The previously existing law was still allowed to take its course against notorious quacks and ignorant pretenders, many of whom were punished by fine and sometimes by exposure in the pillory.

As yet we have no knowledge of druggists as a recognised class of traders. Crude drugs were mostly supplied by grocers, who dealt in foreign drugs as well as grocery, and by herbalists and simplers, who collected indigenous medicinal plants. Those grocers who gave most attention to, and were best acquainted with drugs, became drug-grocers, and these assuming the title of druggists, confined themselves to this class of merchandise. The physicians purchasing the crude drugs from such sources, not only dispensed, but also prepared and compounded such medicines as they administered to their patients. But this practice was felt to be irksome and unsuited for members of a learned profession; therefore, in the early part of the seventeenth century, physicians were getting into the habit of issuing prescriptions, or "bills" as they were then called, which necessarily caused the establishment of dispensing apothecaries, the number of whom must have increased as this new practice extended.

Until the year 1618 there had been no authorized pharmacopœia, and indeed such a work could not have been required while physicians were their own apothecaries; but when prescribing and dispensing became distinct and independent occupations, it was necessary to have a recognised and authoritative standard by which to determine the meaning and value of the terms employed in extemporaneous prescriptions. Hitherto the medicines used belonged principally to the class called galenical, for which complicated formulæ had been handed down from generation to generation for centuries, without any attempt having been made to improve or alter them. But with the sixteenth century a new class of remedies was introduced which, in spite of much opposition, acquired and maintained a position which was daily increasing in importance, and to the more extended use of this class of chemical agents in medicine may in part be ascribed the necessity which arose for a class of men trained and exclusively devoted to the practice of pharmacy, including the preparation of chemical and galenical medicines.

Pharmacy was now for the first time assuming an independent position in this country; but circumstances which followed this result contributed more to the production of a new form of medical practice than to the maintenance and improvement of pharmacy as an independent art. In 1606 the apothecaries, then few in number, formed an alliance and became incorporated with the grocers, but this alliance was shortly afterwards dissolved, and in 1617 the Apothecaries' Company was formed, for which a charter was obtained giving them some exclusive privileges. They established a dispensary near Blackfriars Bridge in 1623, for the preparation of some of the more important medicines then in use, and to this was subsequently added a chemical laboratory in 1671. The medicines prepared or manufactured at this establishment were only supplied to members of the company for use in their practice. The establishment still exists under the title of Apothecaries' Hall, but important changes have been made in the character of the institution and the purposes to which it is applied.

At the time of the formation of the Apothecaries' Company, the number of its members was 114, and that this number included all the then established apothecaries may be inferred from the fact that a few druggists or drug-grocers were included in the Company to make up the number to that of the physicians practising in London.

The apothecaries were a prosperous body, and probably this was to no inconsiderable extent due to the incidence of their advent at a time when wealth and luxury, pestilence and poverty, were providing a rich harvest for doctors of all degrees, while the law had only provided doctors of one, and that the highest degree. Oxford and Cambridge had furnished London with 114 physicians, learned in all the science and mystery of physic as then taught at the Universities, but London with its densely packed and increasing population, with its undrained streets and festering cesspools, seemed to require something more than this to stay the ravages of plague and other forms of pestilence. The apothecaries had been trained in a school in which medicine and pharmacy, dispensing and prescribing, went hand in hand, and it need not be matter of surprise that with so many demands for medical advice for the poor, and for those who could ill-afford to pay a physician, they were easily induced to apply such knowledge as they possessed in ministering to the relief of the sick, without too nicely considering the extent of their qualifications for doing so. It is a significant fact, that although prosecutions were frequently instituted against ignorant quacks, and although the College of Physicians took proceedings against members of the College of Surgeons for prescribing in other than surgical cases, and successfully prevented such practice, yet for a century or more the apothecaries were permitted to pursue an illegal practice which commenced with the treatment of trifling ailments, but grew by degrees and was supported by public opinion, until it not only rivalled, but surpassed in extent, the practice of legally qualified physicians. The result of this was that in less than a hundred years the number of apothecaries increased from 114 to nearly 1000, and notwithstanding the many and strong protests which were made by some of the physicians against the encroachments of apothecaries upon their legitimate functions, this was of no avail so long as there was a great public want that was not otherwise provided for than by allowing the members of a lower grade of the profession to overstep the strict limit of their duties.

It was in the seventeenth century that druggists, as distinguished from grocers, came into existence, and assumed a recognised position among traders. To the title of druggist they afterwards added that of chemist, when chemical medicines came into more general use; but the chemist and druggist was at first and for some time, with perhaps a few exceptions, a mere dealer in drugs and chemicals, without possessing or pretending to possess, the knowledge required for their preparation or production, and as yet they had nothing to do with the dispensing of medicines prescribed by the physicians.

It was not until the middle of the last century that chemists and druggists undertook the duty of dispensing medicines, and they were called to the performance of this duty in consequence of the apothecaries having relinquished the position they had originally occupied and usurped the functions of medical men.

The transference of the dispensing of physicians' prescriptions, however, was not made directly from the apothecary to the chemist and druggist. There was an intermediate period during which much of the dispensing in London was done at institutions, called dispensaries, which had been established by the physicians, ostensibly to enable the poorer classes to get prescribed and other medicines at a moderate cost. These dispensaries, of which there were three, were established in 1697, by subscriptions from the fellows and members of the College of Physicians. The principal establishment was in Warwick Lane, Newgate Street, at the Hall of the College of Physicians, where medicines were not only dispensed but prepared for use in dispensing at the other establishments in St. Martin's Lane, Westminster, and St. Peter's Alley, Cornhill.

The physicians justified the establishment of these dispensaries on the ground that while they were in the habit of prescribing gratuitously for the poor, their patients had no means of getting the prescriptions prepared without taking them to an apothecary, who was often in such cases not only ready to replace the prescriber, but accustomed to make unnecessarily high charges for the medicines supplied.

A very acrimonious controversy took place between the physicians and apothecaries respecting these dispensaries, and they were at length given up when druggists undertook the duty of dispensing, for which they had been preparing themselves.

There is reason to believe that the physicians' dispensaries, while they existed, were the schools at which instruction was principally acquired by those who were intending to establish themselves as dispensing chemists and druggists. By the middle of the last century, the dispensaries had disappeared, and soon afterwards chemists and druggists began to display the notice, "Physicians' prescriptions carefully prepared."

We thus arrive at the distribution of medical and pharmaceutical duties, such as exists at the present time; and it will be seen that the arrangements adopted when druggists took the position previously occupied by the apothecaries, resulted from the growing wants of the public, which were not otherwise provided for. Legislation has followed our medical and pharmaceutical institutions with slow and reluctant steps, and has been chiefly directed to the remedy or prevention of evils when these have appeared and have grown into serious abuses. At the time when druggists became dispensers of medicines, no adequate provision had been made by the legislature for the medical treatment of all classes of the population. Colleges of physicians and surgeons had been established with powers, which, if they had been exercised to their fullest extent, would have left a large proportion of the people without even the consolation of having their ailments ministered to by those who, although not possessing the highest medical knowledge, were the only medical advisers their means enabled them to consult. The apothecary, without any specified or required qualifications for such a duty, had become the poor man's doctor, and public opinion and the liberality and good sense of the heads of the medical profession enabled him to maintain that position until better arrangements were made.

The regulations adopted in other countries present a marked contrast with such as have existed here. From early periods, dating back to the twelfth and thirteenth centuries, we may trace the recognition of pharmacy as a distinct and separate branch of the medical profession in continental countries. In France and Germany apothecaries' shops existed in most of the large cities in the thirteenth, fourteenth, and fifteenth centuries, and these were sometimes kept up at the public expense, with botanic gardens attached to them. The number of these establishments greatly increased in the fifteenth and sixteenth centuries, when they were placed under strict regulations. Laws were passed for regulating the practice of pharmacy in France in the early part of the sixteenth century, and on several occasions throughout that century. The tendency of legislation in France, Germany, and Italy was to effect and maintain a complete separation between the treatment of disease and the preparation and dispensing of medicines. The law defined and limited the nature of the occupations, in the critical direction, which practitioners of pharmacy were allowed to engage in, and a sense of emulation stimulated the members of the body thus circumscribed in their pursuits to the attainment of the qualifications required for the discharge of the duties assigned to them. It was never a question with them whether they should become general practitioners of medicine; if it had been, pharmacy and the shop would have gradually sunk in their estimation, while they were seeking to attain to a higher grade in the profession of medicine. But tied as they were to the plain and legitimate duties connected with the preparation and dispensing of medicines, the only direction in which they could hope to elevate their social and professional position was that of increasing their professional qualifications. Long before pharmacy had emerged in this country from the condition in which it was represented by the physicians' assistants, there was a class of independent apothecaries or pharmaciens in Paris who were supporting a school for the special instruction of those who were intending to devote themselves to this occupation. In the year 1576 this school was founded by a public-spirited pharmacist, Nicholas Houel, who deserves to be canonized among pharmaceutical worthies. The Paris School of Pharmacy afterwards received the support of the corporation of apothecaries, and ultimately became the College of Pharmacy, in which so many distinguished pharmaciens have been trained.

By these and similar means, adopted not only in France, but also in most other continental countries, the practice of pharmacy being strictly defined and limited to the exercise of functions for which its followers were especially and well qualified, has assumed the character of a profession, the members of which fill an important position in the social scale.

If we now return to our own country and to the middle of the eighteenth century, we find laws existing for regulating the qualifications of physicians and surgeons, and for restricting medical and surgical practice to examined and approved members of those branches of the profession. We also find a Society of Apothecaries with a charter authorizing them to prepare, dispense, sell, and administer medicines. These apothecaries, having been originally the servants, were now the attendants of the physicians, whose duty it was, if called in with a physician, to carry his instructions into effect, not only preparing and sometimes administering the prescribed medicines, but performing operations that are now left to the nurse. To a certain extent, the apothecary was supposed to be, and generally was, an educated man; that is to say, he had served an apprenticeship to one of the same class, and being intimately associated with the physicians, he had frequent opportunities of observing how they treated their patients, especially as the prescriptions, or "bills" as they were called, all passed through his hands. Pope, in his "Essay on Criticism," which was written in the early part of last century, says:—

"So modern 'potecaries' taught the art
By doctors' bills to play the doctors' part;
Bold in the practice of mistaken rules,
Prescribe, apply, and call their masters fools."

But not unfrequently the apothecary was called in without the physician, and then he usurped the functions of both, for which however, his education had not properly qualified him, for he had not necessarily received a systematic and scientific education, nor had he passed any examination. This was a subject of complaint between the physician and apothecary, which for a century or more had been growing stronger and louder. As a natural consequence, physicians ceased to advocate the calling in of an apothecary and transferred their patronage to the rising and rapidly increasing class of chemists and druggists. We find this class of recently introduced compounders and dispensers of medicines taking zealously to their new occupation, and apparently thriving, as the apothecaries had done when they first started on their career. They were good men of business, but had no pretensions to much education of any sort, and they were not even required, as the apothecaries were by their charter, to have served an apprenticeship to one who practised the same art.

The rise and progress of dispensing chemists and druggists caused, as might have been expected, a falling off in the prosperity of the apothecaries, and complaints soon began to be made on this account.

In 1748 an Act was passed which extended the powers given to the Society of Apothecaries by their charter and enabled them to examine and grant licences to those who were authorized to act as apothecaries in and within seven miles of London. It was through the power supposed to have been given to them by this Act that they endeavoured some years afterwards to prevent druggists, not only from dispensing the medicines prescribed by physicians, but also from selling any compounded medicines. It is probable that, strictly speaking, they had legally acquired a monopoly in these respects, but when it was known how they intended to apply the power they had acquired, it soon became evident that the public and the higher branches of the medical profession would not support them in maintaining such a position.

It was not until the end of last century that any active steps were taken with the view of contesting the right of chemists and druggists to prepare, compound, dispense, and sell medicines. In 1793 an association of apothecaries was formed, for the purpose of investigating the causes of the diminished prosperity which was complained of among their fraternity, and which was ascribed to two principal causes.

"First, the encroachment which chemists and druggists have, of late years, made on the profession of the apothecary, by vending pharmaceutic preparations, and compounding the prescriptions of physicians.

"Secondly, the want of a competent jurisdiction in the profession itself, to regulate its practice and to restrain ignorant and unqualified persons from practising at all."

A committee of twenty members was appointed, who met once a month at the Buffalo Tavern, in Bloomsbury Square, and by means of an extensive correspondence with apothecaries throughout the kingdom they obtained a vast amount of statistical and other information, which was published in their reports, and a detailed account of which is given by Mr. Bell, in his "Historical Sketch of Pharmacy." It was ascertained as the result of the inquiry that druggists were springing up in every part of the country, and in some places with a four-fold increase in ten or twelve years; that they undertook the dispensing of prescriptions and the sale of medicines of all sorts, and were in the frequent habit of prescribing for those who applied to them for advice. Evidence was adduced to show that many of these druggists were ignorant of the meaning of terms used in prescriptions, and of the qualities and effects of the drugs they were dealing in; but the evidence went also to show that not a few of those who practised as apothecaries were equally ignorant, and that even the power given to the Society of Apothecaries by the Act of 1748 to grant licences on examination was only partially and very imperfectly applied. The final result of the committee's labour was that addresses embodying these facts and suggesting a system of reform were presented to the Colleges of Physicians and Surgeons and the Society of Apothecaries, after which a petition was presented to the House of Commons, and there the matter ended.

The physicians and surgeons had taken no part in this contest between the apothecaries and chemists and druggists. Even the Society of Apothecaries in their corporate capacity appear to have held themselves aloof. All the parties interested, and still more those who were disinterested, must have seen that the contention had reference to private gain more than the public good. Yet there can be no doubt that great advantage resulted from the searching inquiry that was made into the merits and demerits of the opposing candidates for public favour. Public opinion had given to the apothecaries, or at least had called them into, a position which was by no means an unimportant one, but it obviously involved the relinquishment of that which they had previously held, and which was now being handed over to the chemists and druggists. Neither party were as yet fully qualified for the duties they were undertaking; and of this, if they were not themselves previously sensible, they must have been rendered so by the discussions which took place on the subject. The contest was comparatively a short and harmless one, and being over, each party no doubt retired with the wise determination to set his own house in order before he again complained of his neighbour's. Such a resolution, if carried into effect, must have tended to strengthen the chemists in their position; for the better qualified their adversaries became for medical practice, at which they were aiming, the less fitted they must necessarily have become for the duties of dispensing. On the other hand, a large number of chemists and druggists, including the founders of many pharmaceutical establishments in London and various parts of the country which have acquired and sustained high reputations, devoted themselves to the carrying out of the most approved methods of preparing and dispensing medicines, which secured to them extensive patronage, and enabled them effectually to silence any further attempts at an outcry such as was previously raised by the apothecaries on account of the assumed encroachment of chemists on their privileges.

A period of eighteen years now elapsed before any further steps were taken to legislate on medical affairs; but in 1813 an association of apothecaries, not the Society of Apothecaries, again appeared in the field, and introduced a bill into parliament, which proposed to create a licensing board consisting principally of apothecaries with a few physicians and surgeons, who were to have the power of licensing not only apothecaries, but chemists and druggists also, although the latter were not to be represented in, and were to have no voice in the election of, the board. This bill was immediately opposed by the chemists, and as it met with little favour either in or out of the profession, it was soon withdrawn.

Two years afterwards the Society of Apothecaries took up the subject of legislation and carried the Apothecaries Act of 1815, by which the practice of apothecaries has been since regulated. If we may judge from the statements of the authors of that bill and their representatives, the measure was not intended to interfere in any way with the then established and admitted practises of chemists and druggists in preparing, dispensing, and selling medicines. The Committee of chemists and druggists, however, who were appointed to watch the progress of the measure, influenced perhaps by the attempt which had previously been made, on the strength of the then existing law, to prevent any but apothecaries from dispensing prescriptions, insisted on having a clause introduced into the bill which should not only in general terms exempt chemists and druggists from its operation, but should specify the acts for which such exemption was granted. In the clause as it stands in the Act the words "in the buying, preparing, compounding, dispensing, and vending drugs and medicinable compounds, wholesale and retail," were introduced at the suggestion and by the desire of the Committee acting under the advice of counsel. In fact, everything that was asked for by the Committee was granted, and the bill passed without further opposition.

By this Act the original charter granted to the Society of Apothecaries by King James the First in 1617 was confirmed, except that the jurisdiction of the Society, which by the charter had been limited to London and its environs, was now extended to England and Wales, and fresh powers were given them to examine candidates and grant certificates to such as were qualified to practise as apothecaries or to act as assistants to apothecaries. The Act having recited that, "whereas it is the duty of every person using or exercising the art and mystery of an apothecary to prepare with exactness, and to dispense such medicines as may be directed for the sick by any physician lawfully licensed by the president and commonalty of the Faculty of Physic of London, or by either of the Universities of Oxford or Cambridge," proceeds to enact that every apothecary shall be subject to a penalty if he refuse to make, mix, dispense, apply, or sell any medicines so prescribed by a physician, or if he negligently, falsely, or fraudulently prepare and sell such medicines. These, however, were mere confirmations of what had previously been considered to be the duties of an apothecary as defined in their Charter and in the Act of 1748. The important feature of the Act of 1815 is contained in the fourteenth clause, which specifies that no person thereafter, except those previously practising, shall be authorized to practise as an apothecary in England or Wales, unless he has been examined and has proved his skill and abilities *in the science and practice of medicine*, and his fitness and qualifications to practise as an apothecary. This gave to the apothecaries, by legal enactment, what they had previously assumed in opposition to many protests from physicians, namely, the right to practise medicine. The clause in the Act which exempts chemists and druggists from its operation as far as relates to "the buying, preparing, compounding, dispensing, and vending drugs, medicines, and medicinable compounds," established the right which chemists had also previously assumed in opposition to many protests from apothecaries, but it had become more important to have this right clearly defined, as now for the first time there were heavy penalties imposed on those who infringed the privileges of the apothecaries.

Under this Act the apothecaries entered upon a new career; and although it was some time before any marked change was observed in the general character of this part of the profession, yet gradually they have become more highly qualified for their professional duties, and being now merged in the great body of medical practitioners, they occupy an important and honourable position among those to whom all medical and sanitary affairs are entrusted. Their weak point, no doubt, is materia medica and pharmacy, which might be advantageously relinquished by those who practise medicine if the habits and requirements, not to say the necessities, of the public would admit of it.

A long interval was allowed to elapse after the passing of the Apothecaries Act before any measures having a similar object were adopted for regulating the qualifications of chemists and druggists. What has since been done by the Pharmaceutical Society is too well known and appreciated by those I am addressing to require comment here. A distribution of medical and pharmaceutical duties has been gradually effected to meet the exigencies of a great mixed population, and to the extent to which these have been established by law the public are provided with the means of having their medical wants supplied by men well qualified in their several departments.

We represent one of these departments, in connection with which we are endeavouring to raise the standard of professional proficiency by promoting scientific research in those branches of knowledge which relate to the preparation of medicines. This is our special object, and although for the purpose of meeting what has been represented as a present want among our members, I have referred to some historical details, it has been my desire to deal with them simply as matters of fact which are not intended for general discussion here. Our tendencies lie in another direction; and I feel assured that the matter which will be submitted for our consideration, and the discussions relating to it, will show that we are following out our own proper subjects and advancing their scientific and practical study in a way best calculated to make the practice of pharmacy at once honourable and useful to those who are engaged or interested in its pursuit.

Mr. Balkwill (Plymouth) proposed a vote of thanks to the President for his opening address. Last year, at Glasgow, he had delivered an address which he characterized as an outspoken and eminently useful one, and that of this year seemed to be no less so. The future could only be judged by the past; and if there had been times of difficulty heretofore which had been safely passed through by those now occupying honourable positions in the community, it was highly encouraging to those who could not help seeing that the present time was one of transition in relation to pharmacy. The distinguishing mark of the present day was division of labour, and for his own part he accepted most thankfully the fact that their field of labour was entirely distinct from that of the medical man. At the same time their field lay side by side with that of the physician, and their duties could not be properly carried on without a knowledge of some of those matters which properly belonged to medicine, especially physiology and therapeutics. In nothing probably was there greater ignorance than in therapeutics, and he believed that most light was to be thrown upon it from the side of pure chemistry; and he wished therefore that those who were studying chemistry in the laboratory could have opportunities of studying it in the human body, because he believed that in this way more useful results might probably be derived than even from the ordinary practice of medicine. He just threw out this idea, but he must add that he was quite aware of the temptation to which such studies might give rise, and that some might be tempted to dabble in prescribing, and to become bad medical practitioners instead of good chemists. Still it must be remembered that no position in life was free from temptation, and this seemed to him to hold out a most promising field for research.

Mr. E. Smith (Torquay) seconded the motion, which was put by Mr. Groves as senior Vice-President, and carried by acclamation.

The President having briefly thanked the meeting, the reading of papers was commenced.

The first paper read was a report of the Committee appointed in 1876 for the purpose of continuing investigations on the aconite alkaloids (consisting of Mr. T. B. Groves, Mr. J. Williams, and Dr. C. R. Alder Wright): being the—

THIRD REPORT ON THE CHEMISTRY OF THE ACONITE ALKALOIDS.

By C. R. Alder Wright, D.Sc. Lond.,

Lecturer on Chemistry in St. Mary's Hospital Medical School; and

A. P. Luff,

Demonstrator of Chemistry in St. Mary's Hospital Medical School.

Since the presentation of the second report last year, a large number of experiments have been made in the hope of obtaining information as to the chemical "structure" of aconitine (the chief crystallizable active alkaloid of *Aconitum Napellus*), and of pseudaconitine (the main crystallizable active base of *A. ferox*). Although the experiments are not yet completed, yet several points of considerable pharmaceutical and chemical interest have been arrived at, and a number of discrepancies in the results obtained by former observers have been reconciled and cleared up; whilst an explanation has been gained of several perplexing circumstances connected with the preparation of alkaloids from the roots of various species of aconites, and in particular of the great differences in physiological potency sometimes exhibited by different specimens of alkaloids derived from these plants. Some valuable information as to the deficiencies and imperfections of the manufacturing processes for the isolation of these alkaloids has also been gained; and a method of assaying elaborated whereby a sufficiently close approximation to the percentage of active alkaloid contained in the manufactured bases can be readily attained.

The experiments made may be most conveniently described in five sections, referring respectively to the decomposition products of aconitine; those of pseudaconitine; the further investigation of the alkaloidal constituents of different species of the aconite family; processes for assaying commercial aconite alkaloids; and the conclusions to be drawn from the work hitherto done on the subject.

§ 1. Decomposition Products of Aconitine. Action of Water on Aconitine.

When aconitine is heated to 140°–150° in a sealed tube with water, for from 10 to 24 hours, it completely dissolves, forming a slightly yellowish liquid of *acid* reaction; this latter circumstance clearly indicates either that one equivalent of acid is produced by the decomposition for one of nitrogenous decomposition-product, or else that the latter substance is deficient in acid-saturating power; the latter appears to be the case from the following results:—

One gram of pure aconitine thus treated yielded an acid liquid to which a known quantity of standard soda solution was added until strongly alkaline; the fluid was then agitated with ether, to remove, as far as possible, bases, and the excess of alkali was then titrated with standard acid. In this way it was found that the acid produced permanently neutralized 14·1 c.c. of decinormal soda solution, equivalent to 0·909 gram of aconitine, or somewhat less than one equivalent of acid for one of aconitine employed, the deficiency being due, as will be subsequently shown, to the imperfect removal from the alkaline fluid of the complementary nitrogenous product.

The reaction is indicated by the equation—

$$C_{33}H_{43}NO_{12} + H_2O = C_7H_6O_2 + C_{26}H_{39}NO_{11},$$

the acid produced being *benzoic acid*. To the complementary product, $C_{26}H_{39}NO_{11}$, it is proposed to assign the term "*aconine*," to represent its connection with aconitine, which, in fact, as shown below, is apparently *benzoyl-aconine*, $C_{26}H_{38}(C_7H_5O)NO_{11}$. The benzoic acid thus produced was quantitatively determined by adding hydrochloric acid to the product of the action in sealed tubes, agitating with ether, and allowing the ethereal solution to evaporate spontaneously, the residue being finally dried for a night over sulphuric acid; when weighed quantities of benzoic acid were thus treated as a check on the method, almost exactly the amount employed was regained. In hot weather, by exposure to air for some days, however, a considerable volatilization of benzoic acid takes place. In this way—

2·910 grams of aconitine yielded 0·441 of benzoic acid
3·000 ,, ,, ,, 0·479 ,, ,,

	Calculated from above equation.	Found.
Benzoic acid per 100 aconitine used,	18·9	15·2 16·0

The numbers found are sufficiently near to show (when taken in connection with the subsequent data) that the above equation represents the main change taking place.

After recrystallization from boiling water, the acid melted at 120·5° and possessed all the physical characters of ordinary benzoic acid, yielding also its qualitative reactions; on combustion—

0·2090 gram gave 0·5215 CO_2 and 0·0935 H_2O.

		Calculated.	Found.
C_7	84	68·85	68·05
H_6	6	4·92	4·97
O_2	32	26·23	
$C_7H_6O_2$	122	100·00	

The isolation of the complementary product was a matter of far greater difficulty, on account of its peculiar properties. As above stated, it is only imperfectly removed from an aqueous alkaline solution by agitation with ether; the ethereal extract dried up to a wholly non-crystalline varnish, but this did not seem to be the body in a state of purity, being contaminated with traces of unaltered or differently changed aconitine, bye-products, etc., and in particular giving a slight precipitate on solution in a drop of hydrochloric acid and addition of sodium carbonate, which does not occur with pure aconine salts. Attempts were first made to obtain aconine as hydrochloride by adding hydrochloric acid to the product of the action in sealed tubes, removing benzoic acid by agitation with ether, and then evaporating to dryness; but in this way a substance was obtained which was not only impure from the admixture of the bye-products, etc., capable of solution in ether when the solution was rendered alkaline, but also contained some products formed by the action of the excess of hydrochloric acid on the aconine during the evaporation: the residue refused to crystallize and gave the following numbers:—

0·2685 gram gave 0·5470 CO_2 and 0·1995 H_2O
0·3870 ,, ,, 0·1080 Ag Cl

	Calculated for $C_{26}H_{39}NO_{11}HCl$.	Found.
Carbon	54·03	55·56
Hydrogen	6·93	8·25
Chlorine	6·15	6·91

Attempts to prepare the gold salt were not more successful, as the aurochloride when first precipitated forms yellow flakes, but during drying these clot together, forming a resinous substance which is apparently somewhat decomposed: this gold salt is somewhat soluble in water, and the solution leaves, on standing over sulphuric acid in the dark, a resinous substance containing particles of metallic gold indicating reduction and decomposition.

0·9500 grains of resinous gold salt formed by the clotting together of the precipitate, gave 0·2250 Au = 23·68 per cent.

The formula $C_{26}H_{39}NO_{11}HCl.AuCl_3$ requires 22·27 per cent.

The following process, however, was found to yield aconine compounds in a state of tolerable purity. The liquid obtained by acting in sealed tubes with water on aconitine was rendered slightly acid by hydrochloric or sulphuric acid, and freed from benzoic acid by agitation with ether; it was rendered slightly alkaline by sodium carbonate, and again agitated with ether to remove bye-products, etc., soluble therein. The alkaline fluid was then evaporated to dryness, and treated with absolute alcohol, or better, chloroform. The substance thus dissolved out was found to differ in character according to the amount of sodium carbonate added in the earlier stage of the process; if the carbonate was in quantity insufficient wholly to neutralize the sulphuric or hydrochloric acid originally used to acidify, a basic sulphate or hydrochloride was dissolved out; but if a large excess of sodium carbonate was used, the soluble body was simply aconine itself, contaminated with small quantities of sodium carbonate. The following numbers were obtained, due corrections being made for inorganic substances when small quantities of these were present.

Basic Sulphate of Aconine.

0·3250 gram gave 0·6615 CO_2 and 0·2995 H_2O
0·5405 ,, ,, 0·0300 $BaSO_4$

	Calculated for $7 C_{26} H_{39} NO_{11} . H_2SO_4$	Found.
Carbon	56·22	55·51
Total Hydrogen	4·08	7·84
H_2SO_4	2·52	2·35

Basic Hydrochloride of Aconine.

1·1255 gram gave 0·1790 Ag Cl
0·3277 ,, ,, 0·6595 CO_2 and 0·2320 H_2O

	Calculated for $3 C_{26} H_{39} NO_{11} . 2 HCl.$	Found.
Carbon	55·19	54·88
Hydrogen	7·02	7·86
Chlorine	4·18	3·94
Nitrogen and Oxygen (by difference)	33·61	33·32
	100·00	100·00

Free Aconine.—It was found difficult to obtain aconine perfectly free from all traces of inorganic matters. On treatment with absolute alcohol of the purified aconine salts evaporated to dryness with excess of carbonate of soda, small quantities of sodium carbonate and chloride, etc., are dissolved out; whilst they are not wholly separated by again evaporating to dryness and taking up with chloroform.

0·2335 of substance, purified by absolute alcohol, gave 0·500 CO_2 and 0·1830 H_2O.

Another sample further purified by chloroform: 0·2725 gram gave 0·5740 CO_2 and 0·1990 H_2O.

		Calculated.	Found.	
C_{26}	312	57·67	58·39	57·45
H_{39}	39	7·21	8·71	8·12
N	14	2·59		
O_{11}	176	32·53		
$C_{26}H_{39}NO_{11}$	541	100·00		

Aconine is very readily soluble in alcohol and chloroform, but is almost insoluble in ether; the solutions are bitter and produce no tingling of the skin or lips. Aqueous solutions precipitate, when moderately concentrated, tannin, gold chloride, and lead acetate. In all these respects aconine exactly agrees with the "acolyctine" of Hübschmann (*Jahresbericht*, 1876, 483) and of Von Schroff (*N. Repert. Pharm.*, xx., 641), obtained by the former from the roots of the yellow-flowered aconite by a process which involved heating the alcoholic tincture of the root with lime and also with sulphuric acid, and finally evaporating to dryness with sodium carbonate, separation of matters soluble in ether, and purification by solution in chloroform. As shown below, these processes must inevitably have decomposed aconitine, if originally present, with formation of aconine; hence there seems to be good reason for supposing that the "acolyctine" of Hübschmann (and consequently the "napelline" of the same chemist, discovered by him in commercial so-called "aconitine" (*Jahresbericht*, 1857, 416, and subsequently stated by him to be identical with "acolyctine"), is not a natural alkaloid characteristic of a particular species of aconite, but is simply a decomposition product of aconitine formed by the violent treatment to which the roots were subjected; and this is rendered the more probable in that the second base (so-called "lycoctonine") found simultaneously by Hübschmann, is apparently the analogously formed decomposition product of pseudaconitine (*vide* § 2); whilst, on the other hand, both aconitine and pseudaconitine appear to occur both in *A. Napellus* and *A. ferox* roots, the former predominating in the first and the latter in the second species (*vide* § 3).

On adding potassium mercuriodide to a solution of an aconine salt (rendered slightly acid by hydrochloric acid), a flocculent white precipitate is thrown down, much resembling the analogously formed precipitates with aconitine and pseudaconitine, but sensibly more soluble in excess of the reagent, and on dilution of the turbid fluid with water. After drying over sulphuric acid, and finally at 100°, this compound gave the following numbers:—

0·4155 gram gave 0·2570 Ag I. Iodine, 33·43 per cent.

Calculated for—
$C_{26} H_{39} N O_{11}. H I. Hg I_2.$ Iodine, 33·93 per cent.

It deserves notice that benzoic acid has been previously obtained by the decomposition of two other alkaloids, viz., atropine (Kraut, *Jahresbericht*, 1855, 448) and cocaine (Lossen, *ibid.*, 451).

The decomposition of aconitine in accordance with the equation—

$$C_{33} H_{43} N O_{12} + H_2 O = C_7 H_6 O_2 + C_{26} H_{39} N O_{11},$$

seems to indicate that aconitine is *benzoyl-aconine*, $C_{26} H_{38} (C_7 H_5 O) N O_{11}$, analogous to the benzoylated, acetylated, and butyrylated morphine and codeine prepared by one of us in conjunction with Mr. G. Beckett (*Chem. Soc. Journal*, 1874, 1031, and 1875, 15 and 312). It might be hence supposed that by acting on aconine with benzoic anhydride aconitine might be reproduced in accordance with the equation—

$$C_{26} H_{39} NO_{11} + (C_7 H_5 O)_2 O = C_{26} H_{38} (C_7 H_5 O) N O_{11} + C_7 H_6 O_2.$$

On trying the experiment this seems to be the case; but the action does not stop here, *two* benzoyl groups being apparently introduced, so as to give rise to a *benzoyl-aconitine* or *dibenzoyl-aconine*, $C_{26} H_{37} (C_7 H_5 O)_2 N O_{11}$. This substance forms a hydrochloride much less soluble than that of aconitine; its gold salt is a stable body not decomposed at 100°, and the solutions of the salts of the base are precipitated by carbonate of soda. As yet we have not prepared it in sufficient quantity to obtain it perfectly pure, wherefore we leave its description until our experiments are further advanced. It is particularly noteworthy that a substance of exactly the same properties and composition is obtained by the action of benzoic anhydride on aconitine itself by virtue of the reaction.

$$C_{36} H_{38}(C_7 H_5 O)N O_{11} + (C_7 H_5 O)_2 O =$$
$$C_{36} H_{37} (C_7 H_5 O)_3 N O_{11} + C_7 H_6 O_2.$$

Hence in the formation of aconine from aconitine there does not seem to be any "molecular rearrangement."

Action of Alkalies on Aconitine.

As might be expected, the saponifying action of water on aconitine is greatly intensified if alkalies be present; thus, if excess of ammonia be added to a solution of an aconitine salt, and the whole be allowed to stand for some hours in the cold, a perceptible amount of action takes place, benzoic acid being obtainable from the solution by simply acidifying and shaking with ether. If the alkaline liquid be boiled, the action is brought about yet more quickly; complete solution speedily takes place, not from the greater solubility of aconitine in the heated fluid, for the reverse seems to be the case, but from the splitting up of the aconitine into the two products aconine and benzoic acid, each of which is readily soluble in ammonia. Fixed alkalies and sodium carbonate act in the same way. It may be noticed that this splitting up is the cause of the peculiar phenomenon observed by Mr. Groves (*Year-Book*, 1873, 508; *Pharm. Journ.*, 3rd series, iv., 295), viz., that an ammoniacal solution of aconitine after standing thirty hours yielded on acidification no precipitate whatever with potassium mercuriodide; the aconine formed giving rise, as above stated, to a double iodide with mercury sensibly more soluble in water than the corresponding salts of aconitine and pseudaconitine. One practical conclusion to be drawn from this is, that in the isolation of aconitine, prolonged contact of the free base with alkaline solutions must be avoided as far as possible; very probably the different yields of aconitine obtained by different observers are quite as much due to varying amounts of loss of aconitine through this decomposition as to differences as to the amounts originally contained in the roots.

Action of Acids on Aconitine.

The action of acids on aconitine is not so marked as that of alkalies, being scarcely appreciable in the cold, though energetic enough in some cases at 100°. An acid solution of hydrobromide of aconitine was allowed to stand in a covered beaker for eight months; at the end of that time only minute quantities of benzoic acid could be extracted by ether. Again, aconitine was dissolved in a large excess of tartaric acid, and the solution kept boiling (an inverted condenser being attached) for twelve hours: at the end of this time only traces of benzoic acid could be extracted by ether.

Hot inorganic acids, however, act much more rapidly; thus an appreciable formation of benzoic acid is noticeable on boiling for some hours a slightly acid solution of aconitine in very dilute sulphuric acid; when 20 parts of 5 per cent. acid are employed (1 part aconitine, 1 H_2SO_4, and 20 of water) a considerable action ensues, about a third of the aconitine being converted into aconine and benzoic acid at the end of twelve hours. On adding sodium carbonate in excess to the acid liquid (previously freed from benzoic acid by agitation with ether) unchanged aconitine is precipitated and aconine remains in solution; by evaporating the solution to dryness and treating with chloroform or absolute alcohol this is dissolved out from the sodium sulphate and carbonate. The benzoic acid thus produced melted at 121°, and gave all the reactions and possessed the physical characters of that acid. The carbonate of soda precipitate was carefully examined to see if it contained any other substance beside aconitine, but without success; on treatment with hydrobromic acid it furnished crystals of aconitine hydrobromide.

0·960 gram lost 0·061 at 100° = 6·35 per cent.
Calculated for $C_{33}H_{43}NO_{12}.HBr.2\frac{1}{2}H_2O = 5{\cdot}83$.
0·612 gram of dried salt gave 0·1560 Ag Br. Br = 10·84 per cent.
Calculated Br = 11·02 per cent.

The mother liquors of these crystals deposited more of the same crystals on evaporation, and the final mother liquors gave with a little ammonia a precipitate which furnished a gold salt of which—

0·5070 gram gave 0·0835 Au = 20·51 per cent.
Calculated for aconitine aurochloride = 19·92 per cent.

It may hence be inferred that the use of sulphuric acid for extracting aconitine from aconite roots, as usually practised, is likely to cause a considerable amount of loss of aconitine by splitting it up into benzoic acid and aconine; whilst the employment of tartaric acid, as suggested by Duquesnel, is comparatively free from this objection.

When hot concentrated mineral acids are in contact with aconitine, the saponifying action takes place very quickly: thus on heating aconitine to 100° in a sealed tube for three hours with about 15 parts of concentrated hydriodic acid solution, 8·3 per cent. of benzoic acid was obtained, or about half as much as was formed by the complete decomposition of the aconitine; the aconine produced is probably further altered by the hydriodic acid, but the nature of the product has not yet been examined. No methyl iodide was formed during the reaction, but that does not prove that the aconitine does not contain a methyl group, as the same negative result was also obtained in a companion experiment at 100° with pseudaconitine, which contains two methyl groups (*vide* § 2). Similar results were obtained on heating with concentrated hydrobromic acid to 100°, benzoic acid, melting at 120°–121°, being formed in quantity.

§ 2. DECOMPOSITION PRODUCTS OF PSEUDACONITINE.

In the first report (*Year-Book*, 1875, 514; *Pharm. Journal*, 3rd series, vi., p. 188), the formula $C_{36}H_{49}NO_{11}$ was assigned to pseudaconitine as the most probable one; the experiments since made confirm this formula, although it cannot be regarded as established with the same certainty as that of aconitine, $C_{33} H_{43} N O_{12}$, owing to the difficulty in forming any definite crystallized salt of pseudaconitine.

The amount of pseudaconitine at our disposal not being large, we took advantage of the circumstance that Messrs. Hopkin & Williams have recently worked up a considerable amount of alkaloid from *A. ferox* roots into a commercial preparation. As shown further on, this substance was very far from being pure pseudaconitine; but still it contained a considerable amount of that base, which was easily isolated by the purification process of M. Duquesnel, viz., dissolving in ether, adding light petroleum spirit, pouring off from a little watery and resinous matter thus thrown down, and finally allowing to crystallize by spontaneous evaporation. In this way something like one-third of the weight of material employed was obtained in a crystallized condition after collecting on the pump filter and slightly washing with ether and ether-petroleum mixture. A considerable amount of pseudaconitine was contained in the filtrate from these crystals, being prevented from crystallizing well by other matters also present; the filtrate dried up to a resinous mass in which a few crystals were interspersed; for the examination of this (*vide* § 3). The crude pseudaconitine crystals thus obtained were purified by a repetition of the process and then gave the following numbers:—

(1) 0·3225 gram gave 0·7465 $C O_2$ and 0·2135 $H_2 O$.

In order still further to purify the crystals they were dissolved in hot alcohol, and water added until the solution became milky; alcohol was then added till the whole was clear, and the liquid then set aside to cool in a covered beaker. Crystals exactly resembling the original ones then separated. These were separated by the pump filter next day and treated in the same way again.

(2) 0·2395 gram of the final crystals gave 0·5540 $C O_2$ and 0·1610 $H_2 O$.

	Calculated.		Found.	
			(1)	(2)
C_{36}	432	64·38	63·13	63·09
H_{49}	49	7·30	7·36	7·47
N	14	2·09	—	—
O_{11}	176	26·23	—	—
$C_{36} H_{49} N O_{11}$	671	100·00		

These numbers do not agree with the formula as sharply as might be desired; on the other hand, the gold salts prepared from these two specimens gave numbers agreeing well with the formula :—

(1) 0·3840 gram of gold salt gave 0·0750 Au.
0·3215 gram of gold salt gave 0·5025 CO_2 and 0·1545 H_2O.

(2) 0·7044 gram of gold salt gave 0·1385 Au.
0·2930 gram of gold salt gave 0·4600 CO_2 and 0·1410 H_2O.

	Calculated for $C_{36}H_{49}NO_{11}.HCl.AuCl_3$	Found. (1)	Found. (2)
Carbon	42·77	42·61	42·82
Hydrogen	4·95	5·34	5·35
Gold	19·40	19·53	19·66

It was subsequently found that these specimens (1 and 2) contained a small quantity of aconitine (*vide* §§ 3, 4); but as the amount of this impurity was very small (less than 1 per cent.), it would not appreciably alter the numerical values.

Owing to the ease with which pseudaconitine breaks up in accordance with the equation—

$$C_{36}H_{49}NO_{11} + H_2O = C_9H_{10}O_4 + C_{27}H_{41}NO_8,$$

parallel with that undergone by aconitine (§ 1), it is very doubtful whether any of the pseudaconitine yet obtained was perfectly pure, being probably more or less contaminated with the decomposition product $C_{27}H_{41}NO_8$; thus the alcoholic mother-liquor from which specimen No. 2 was obtained contained about two-thirds of the crystals No. 1 originally dissolved in a form which did not admit of pseudaconitine crystallizing therefrom; they dried up on evaporation to a varnish, and the change was clearly traced, as shown below, to the occurrence of the above reaction to a great extent in presence simply of the hot aqueous alcohol.

Neither the acid, $C_9H_{10}O_4$, nor the base, $C_{27}H_{41}NO_8$, into which pseudaconitine thus splits is identical with the corresponding aconitine product; the former is found to be *dimethylprotocatechuic acid*, identical with that obtained by methylating protocatechuic acid, and by the oxidation of eugenol; the latter is very different from aconine, but as shown below is in all probability the main constituent of the mixture of bases obtained by Hübschmann from *A. Lycoctonum*, and termed by him "lycoctonine." To indicate this new base, it is proposed to use the term *pseudaconine*, which calls to mind that pseudaconine bears to pseudaconitine the same relationship that aconine does to aconitine. It may be here noticed, parenthetically, that the former researches of one of us have shown that *narcotine* when heated with water splits up in a parallel fashion, forming hydrocotarnine and opianic acid, thus—

$$C_{22}H_{23}NO_7 + H_2O = C_{10}H_{10}O_5 + C_{12}H_{15}NO_3$$

(*Chem. Soc. Journal*, 1875, 573), and that the opianic acid thus produced is chemically allied to dimethylprotocatechuic acid, the two bodies being benzine derivatives represented by the formulæ :—

$$C_6H_2 \left\{ \begin{array}{l} CO.H \\ CO.OH \\ OC.H_3 \\ OC.H_3 \end{array} \right. \quad \text{and} \quad C_6H_3 \left\{ \begin{array}{l} CO.OH \\ O.CH_3 \\ O.CH_3 \end{array} \right.$$

Hence there is a certain amount of family connection between narcotine and pseudaconitine; whilst on the other hand, according to T. and H. Smith (*Jahresbericht*, 1864, 448) the juice of fresh aconite roots contains an alkaloid termed by them "aconellin," which appears to be identical with narcotine.

Action of Water on Pseudaconitine.

The dimethylprotocatechuic acid formed by the saponifying action of water at 140°–150° on pseudaconitine, is easily extracted by acidifying the product of the action with hydrochloric acid and shaking with a large bulk of ether. By spontaneous evaporation of the ethereal solution the following numbers were obtained :—

(*a*) 2·650 grams of the pseudaconitine originally prepared by Mr. Groves and examined in the first report (probably the purest specimen yet obtained, as it gave 63·84 per cent. of carbon on combustion, and its gold salt contained 19·46 per cent. and closely agreeing with the calculated values) gave 0·604 gram of acid.

(*b*) 3·000 grams of pseudaconitine from Messrs. Hopkin & Williams' preparation (crystals No. 1 above) gave 0·6645 gram of acid.

	Calculated for above equation.	Found. (*a*)	Found. (*b*)
Per cent. of acid	27·12	22·8	22·15

The deficiency is probably due partly to the formation of bye-products and partly to the pseudaconitine employed containing an admixture of pseudaconine and a trace of aconitine as above stated.

The acid thus obtained is less soluble in boiling water than benzoic acid, and very sparingly soluble in cold water; after recrystallization from boiling water, two different samples first completely melted at

170°–177° and 177°–178° (corrected) respectively. The following numbers were obtained on combustion:—

0·2325 gram gave 0·5030 CO_2 and 0·1175 H_2O.

		Calculated.	Found.
C_9	108	59·34	59·01
H_{10}	10	5·49	5·62
O_4	64	35·17	—
$C_9H_{10}O_4$	182	100·00	

That the acid was really dimethylprotocatechuic acid was shown further by the circumstance that on fusing at about 250° with caustic potash, acidification of the "melt" and treatment with ether, protocatechuic acid is formed, readily recognised by its remarkable colour reactions. Moreover, the acid obtained, like synthetically prepared dimethylprotocatechuic acid, formed on exact neutralization with ammonia and addition of a drop of concentrated silver nitrate solution a most characteristic gelatinous silver salt. After crystallization from water the acid gave not the slightest trace of colour with ferric chloride; the crystals deposited from water were anhydrous after exposure to air for a few hours, as also were the crystals after draining on the pump filter, washing first with alcohol, and then with ether, and exposure to the air for a few minutes till the ether had evaporated. According to Kölle (*Annalen der Chemie*, 159, 240), dimethylprotocatechuic acid crystallizes anhydrous. Beckett and Alder Wright, however, found (*Chem. Soc. Journ.*, 1876, 304) that the synthetically prepared acid was $C_9H_{10}O_4, H_2O$. In order to obtain pseudaconine in a state of purity the acid liquid from which the dimethylprotocatechuic acid had been removed by ether was rendered alkaline by sodium carbonate and agitated with ether. Unless the solution was tolerably concentrated, no precipitate was formed on rendering it alkaline, and ether then dissolved out but little, pseudaconine being readily soluble in sodium carbonate and not being readily removed from the solution by ether; highly concentrated pseudaconine salts, however, precipitate with sodium carbonate, the precipitated base being readily taken up by ether. By evaporating down the alkaline liquid thus freed from traces of byeproducts, etc., soluble in ether, pseudaconine was obtained as a resinous mass, separating out as the solution became concentrated. The last portions were readily obtained by evaporating to dryness and treating with ether; small quantities of aconine and colouring matters soluble in chloroform were thus left undissolved. Neither from the alcoholic nor the ethereal solutions could pseudaconine be obtained in crystals, only transparent resinous varnishes being left; but on moistening these with water they partially dissolved, the remainder becoming opaque, white, and brittle, readily breaking up into what appeared to be crystalline particles: under the microscope some of these appeared indistinctly crystallized, but most were apparently coalesced globules. This formation of this apparently crystalline mass, from the transparent resin left on spontaneous evaporation of the solution of the base in ether (or ether and petroleum spirit) is extremely characteristic, not having been noticed with any of the other aconite alkaloids or their derivatives. It is especially noteworthy that this peculiar behaviour is, according to Flückiger (*Jahresbericht*, 1870, 837), precisely that of the so-called "lycoctonine" of Hübschmann (*loc. cit. supra*), obtained together with "acolyctine" from *A. Lycoctonum*. Inasmuch as the method adopted for the extraction of the alkaloids must inevitably have more or less converted pseudaconitine, if originally present, into pseudaconine, it is extremely probable that the "lycoctonine" of Hübschmann was simply a mixture of pseudaconine with more or less unaltered pseudaconitine, and possibly a little unaltered aconitine and bye-products, etc. A mixture of about equal quantities of pseudaconitine and pseudaconine does not crystallize from ether alone, but leaves a varnish almost instantly becoming solid and crystalline on touching with water; the crystals thus formed, when dissolved in ether and petroleum spirit, deposit by spontaneous evaporation crystals of impure pseudaconitine. From the marked resemblance between the physical properties of pseudaconine containing pseudaconitine, and those ascribed to "lycoctonine" by Hübschmann, Von Schroff, and Flückiger, together with their exact similarity in deportment with various reagents (*vide infra*), we have but little doubt that "lycoctonine" is really mainly pseudaconine, with more or less pseudaconitine, etc. Taking this into consideration with the apparent identity between aconine and "acolyctine" (§ 1), it may be fairly inferred that the roots of *A. Lycoctonum* contain both aconitine and pseudaconitine, and hence present no remarkable peculiarity as compared with the other species of aconites.

The following numbers were obtained with pseudaconine prepared as above described :—

(1) 0·2410 gram gave 0·5000 CO_2 and 0·1815 H_2O.

Another specimen—

(2) 0·2410 gram gave 0·5630 CO_2 and 0·1815 H_2O.

	Calculated.		Found.	
			(1)	(2)
C_{27}	324	63·90	63·36	63·71
H_{14}	41	8·09	8·37	8·37
N	14	2·76	—	—
O_8	128	25·25	—	—
	507	100·00		

The gold salt of pseudaconine, like that of aconine, appears to have a tendency towards spontaneous decomposition whilst drying; the purest specimen obtained gave these numbers:—

0·4840 gram dried over sulphuric acid gave 0·1145 Au = 23·65 per cent.

Calculated for $C_{27}H_{41}NO_8$, H Cl, Au Cl_3 = 23·17 per cent., somewhat higher percentages were given by other specimens.

Pseudaconine does not seem to form salts that crystallize readily; our examination of its compounds, however, is not yet complete. In particular we propose to examine its behaviour with organic anhydrides, *e.g.*, benzoic anhydride, and to reproduce pseudaconitine from it, if possible. Its physiological action seems to be far less marked than that of aconitine or pseudaconitine. Solutions of its salts are bitter, and produce no tingling of the skin or lips.

Action of Alkalies and Acids on Pseudaconitine.

Pseudaconitine is saponified by alkalies quite as readily as aconitine, if not more so. If a little freshly precipitated alkaloid be boiled with ammonia, the action commences very rapidly. In a few minutes, if hydrochloric acid and ether be added, dimethylprotocatechuic acid is dissolved out in quantity. The same result is brought about on heating with sodium carbonate solution. Pseudaconitine itself, however, is sensibly soluble in sodium carbonate solution. On warming a saturated solution of the base in sodium carbonate the alkaloid separates out as a resinous film, containing but little pseudaconine, and capable of yielding crystals by solution in ether, addition of petroleum, and spontaneous evaporation. By continued heating of the sodium carbonate solution the pseudaconitine is almost wholly decomposed, little but resinous pseudaconine being contained in the base which separates as the solution becomes concentrated, and much dimethylprotocatechuic acid being obtained from the aqueous liquors on acidulation and shaking with ether.

As stated above, heating pseudaconitine with dilute alcohol for the purpose of recrystallizing it, saponifies a considerable quantity, so that only a fraction of the alkaloid used crystallizes out on cooling, the mother-liquors yielding dimethylprotocatechuic acid on acidification, addition of water, and shaking with ether.

On heating pseudaconitine with inorganic acids, the same result is rapidly brought about; thus on heating with about 15 parts of strong hydriodic acid at 100° for three hours, 10·2 per cent. of dimethylprotocatechuic acid was obtained by treatment with ether; similar results were obtained with hydrobromic acid. (It is noteworthy that no methyl bromide or iodide was obtained in these experiments, indicating that dimethylprotocatechuic acid is not really demethylized at 100°). Boiling with dilute sulphuric acid rapidly splits up pseudaconitine; on the other hand, the base may be boiled for several hours with tartaric acid without the formation of more than minute quantities of dimethylprotocatechuic acid. Hence, as with aconitine, tartaric acid is far preferable to sulphuric acid, for the purpose of acidifying the alcohol used in the first extraction of the alkaloids from the roots.

[The table on the following page exhibits the comparative qualitative reactions of aconitine, aconine, pseudaconitine, and pseudaconine. The tests were made with solutions as nearly as possible of the same strength in each case, and consisting of the alkaloids dissolved in the least possible excess of hydrochloric acid, so as to give a slight acid reaction.]

§ 3. ALKALOIDS CONTAINED IN VARIOUS ACONITE SPECIES.

The experiments described above (§§ 1, 2) seem to leave little room for doubt that the "acolyctine" and "lycoctonine" obtained by Hübschmann from *A. Lycoctonum* were really essentially decomposition products of aconitine and pseudaconitine respectively, and hence lead to the presumption that both these parent alkaloids exist in *A. Lycoctonum* roots. This appears also to be the case with both *A. Napellus* and *A. Ferox;* the former of the two species, however, appears usually to contain aconitine in far the largest proportion, whilst in the latter species pseudaconitine greatly predominates. That *A. Ferox* roots, as met with in commerce, contain aconitine is indicated by the circumstance alluded to in § 2, that the product of the action in sealed tubes of water on pseudaconitine derived from *A. Ferox* yielded, on evaporation to dryness with sodium carbonate, a residue from which much pseudaconine was dissolved out by ether, leaving behind a small residuum of an alkaloid which, like aconine, was readily soluble in water, alcohol, and chloroform. Further, the crude dimethylprotocatechuic acid extracted from the product of

The Comparative Qualitative Reactions of Aconitine, Aconine, Pseudaconitine, and Pseudaconine.

Alkaloid.	*Weak Bromine Water.*	*Iodine dissolved in Potassium Iodide.*	*Mercuric Chloride.*	*Mercuric Bromide.*	*Mercuric Iodide dissolved in Potassium Iodide.*	*Tannin.*	*Gold Chloride.*	*Platinum Chloride.*	*Sodium Carbonate.*	*Ammonia.*
Aconitine.	Precipitated, much more copious with stronger solution.	Copious precipitate, scarcely affected by large dilution.	No precipitate with dilute solution; white precipitate with concentrated solution readily soluble on dilution.	Precipitate with dilute solution, readily soluble on large addition of water.	Precipitate in dilute solution, scarcely affected by large addition of water.	No precipitate in dilute solution. Precipitate with concentrated solution readily dissolved on large addition of water.	Flocculent precipitate scarcely affected by large dilution.	No precipitate, save in very concentrated solution; readily soluble in water.	Precipitate sensibly soluble in excess on large dilution, but not very soluble.	Precipitate more soluble in excess on large dilution than with sodium carbonate.
Pseudaconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Same as aconitine.	Precipitate almost as soluble in excess on large dilution as with sodium carbonate.
Aconine.	No precipitate.	Precipitate readily soluble on dilution.	Precipitate only with most concentrated solution; readily soluble on dilution.	Precipitate only with moderately concentrated solution; readily soluble on large dilution.	Precipitate much more soluble on dilution than that given by aconitine.	Precipitate dissolved on dilution.	Precipitate in concentrated solution readily dissolved on adding large bulk of water.	No precipitate in moderately concentrated solution.	No precipitate under any circumstances.	No precipitate under any circumstances.
Pseudaconine.	Precipitate, somewhat more scanty than with aconitine.	Same as aconitine and pseudaconitine.	Same as aconitine and pseudaconitine.	Same as aconitine and pseudaconitine.	Same as aconitine and pseudaconitine.	Precipitate in dilute solution, dissolved on large further dilution.	Precipitate slightly dissolved on dilution, but much less so than that with aconine.	Same as aconine.	No precipitate unless tolerably concentrated solution; readily dissolved on dilution.	Same as with sodium carbonate.

the action by acidulation and treatment with ether contained notable quantities of benzoic acid; these were separated by long continued distillation with water, the dimethylprotocatechuic acid being not volatile under these conditions. The distillate yielded sensible quantities of benzoic acid on neutralizing with sodium carbonate, evaporation to a small bulk, acidification, and treatment with ether. The benzoic acid thus extracted from the pseudaconitine derived from Messrs. Hopkin & Williams's batch of alkaloid represented a content of something under 1 per cent. of aconitine. Similarly benzoic acid was extracted from the pseudaconitine worked up by Mr. Groves, in 1873 (*Year-Book*, 1873, 500), from Nepaul aconite, the quantity representing a little more than one per cent. of aconitine (*vide* § 4).

On the other hand, *A. Napellus* roots appear to contain pseudaconitine in some quantity, the evidence of the presence of this base being as follows:—During the working up of the *A. Napellus* extract as described to the Conference last year (Report No. 2), two batches of mother-liquors were obtained, the one (A) from the successive crystallizations from ether and petroleum of the crude aconitine precipitated by potassium carbonate from the condensed extract prepared by M. Duquesnel's process; the other (B) being the potassium carbonate filtrate from this crude aconitine. From this filtrate a batch of alkaloids was extracted, as mentioned in Report 2, by precipitating with potassium mercuriodide, decomposing the precipitate by sulphuretted hydrogen, and finally treatment with sodium carbonate and ether. These two batches of alkaloid appeared to be much the same in general character, each being a mixture of at least five substances, viz., *aconitine*, prevented from crystallizing out by the others; *aconine*, formed by the partial decomposition of aconitine; *pseudaconitine; pseudaconine*, formed by the decomposition of pseudaconitine; and *a fifth base* containing a higher carbon percentage than any of these; this last has as yet not been isolated in a pure state. On dissolving these two mixtures in hydrobromic acid and allowing to stand some months, a very scanty crop of crystals of aconitine hydrobromide was obtained in each case; the mother-liquors of these dried up to varnishes. On solution of these varnishes in water and pouring into excess of sodium carbonate solution, a separation was effected in each case of some of the constituents; precipitates were thrown down containing aconitine, pseudaconitine, some pseudaconine, and the fifth base; whilst filtrates were obtained containing the rest of the pseudaconine and the aconine. On evaporation of these filtrates impure pseudaconine separated as resinous masses; whilst the final mother-liquors evaporated to dryness, and treated with ether yielded more pseudaconine in solution. On treating the portion insoluble in ether with chloroform, aconine and colouring matters were dissolved out. The pseudaconine thus obtained from the ethereal solutions corresponded exactly in all its characters with that above described (§ 2), and in particular in the apparent crystallization of the resinous alkaloids left on evaporation of the ethereal solutions on bringing them into contact with water. The following numbers were obtained:—

From (A) 0·2280 gram gave 0·5360 CO_2 and 0·1670 H_2O.
From (B) 0·3250 gram gave 0·7555 CO_2 and 0·2330 H_2O.

		Calculated.	Found.	
			(A)	(B)
C_{27}	324	63·90	64·12	63·38
H_{41}	41	8·09	8·14	8·03
N	14	2·76	—	—
O_8	128	25·25	—	—
$C_{27}H_{41}NO_8$	507	100·00		

The two precipitates thus obtained with sodium carbonate were dissolved in acid and reprecipitated by sodium carbonate for the purpose of removing pseudaconine. The residual alkaloids were then collected, washed, and dried; white amorphous brittle masses were thus obtained, not unlike starch in appearance. In acids these white masses dissolved readily, but the solutions would not crystallize. On combustion these masses gave the following numbers; at 100° they did not melt, but slightly fritted together:—

From (A) 0·2950 gram gave 0·7120 CO_2 and 0·2065 H_2O.
From (B) 0·2975 gram gave 0·7140 CO_2 and 0·2030 H_2O.

	(A)	(B)
Carbon	65·80	65·46
Hydrogen	7·78	7·58

It is hence evident that a large quantity of some base was present, containing more carbon than any of the bases yet examined, the highest percentage being found in pseudaconitine (C = 64·38 hydrogen = 7·30 per cent.); these two precipitates consisted mainly of this substance, with a little unaltered aconitine and a minute amount of pseudaconitine; for they produced a slight amount of lip tingling, very far inferior to that produced by either aconitine or pseudaconitine in a pure condition; and on treating with water in sealed tubes for twenty-four hours, each partially dissolved, giving rise to a small quantity of a mixture of benzoic and dimethylprotocatechuic of analysis was adopted: it is evident that the process can be utilized as a means of assaying the comparative value of commercial specimens of alkaloid:—

0·7895 gram lost at 100° 0·0335	=	4·2 per cent.
2·3040 grams dissolved in hydrochloric acid and treated with ether, furnished 0·010 gram of residue left on spontaneous evaporation of ether, consisting of resinous matter with a little dimethylprotocatechuic acid (probably formed by decomposition of pseudaconitine whilst the preparation was drying in Messrs. H. & W.'s factory)	=	0·4 ,,
2·0230 grams, heated to 240°-250° in a sealed tube for 24 hours with water, yielded with hydrochloric acid and ether 0·3660 gram of mixed benzoic and dimethylprotocatechuic acids, with traces of resin .	=	18·1 ,,
On distillation with water 0·002 gram of benzoic acid was obtained, melting at 119° .	=	0·1 ,,

Admitting, as seems most probable from the above-described experiments, that this benzoic acid was derived from aconitine present, 0·1 per cent. of benzoic acid would correspond to 0·6 per cent. of aconitine, since pure aconitine has been found experimentally to yield about one-sixth of its weight of benzoic acid (§ 1). On the other hand, it may be fairly assumed that *pure* pseudaconitine would yield 25 per cent., or one-fourth of its weight, of dimethylprotocatechuic acid, since close upon 23 per cent. was actually obtained from specimens known to be not wholly pure (§ 2); whilst the theoretical value is 27·1 per cent.; hence the percentage of pseudaconitine will be 70·4, as shown by the calculation below:—

Total dimethylprotocatechuic and benzoic acids and resin obtained	=	18·1 per cent.
Resin and pre-existing dimethylprotocatechuic acid	=	0·4 ,,
Acids due to pseudaconitine and aconitine present	=	17·7 ,,
Benzoic acid due to aconitine	=	0·1 ,,
Dimethylprotocatechuic acid due to pseudaconitine	=	17·6 ,,

Percentage of pseudaconitine	= 17·6 × 4	= 70·4
Ditto of aconitine.	= 0·1 × 6	= 0·6
Water		= 4·2
Pseudaconine and amorphous unnamed base, etc. (by difference)		= 24·8
		100·0

That is, the percentage of pseudaconitine is practically four times the percentage of dimethylprotocatechuic acid obtained (after making correction for resin, pre-existing acid, and benzoic acid); whilst the aconitine is practically six times the benzoic acid obtained.

Similarly, a sample of impure pseudaconitine was assayed. This had been obtained by Mr. Groves in 1873, and was described by him (*Year-Book*, 1873, p. 504) under the name of "amorphous pseudaconitine," being the substance referred to as "Specimen F," in first report (*Year-Book*, 1875, p. 515); this was found, by treatment with acid and sodium carbonate, solution of precipitate in ether, addition to benzoline, and spontaneous evaporation, to contain much crystallizable pseudaconitine, the crystallization of the original substance being impeded by other products, notably pseudaconine and dimethylprotocatechuate of pseudaconitine, which were to a large extent removed in the sodium carbonate filtrate by this treatment.

Percentages found.		Calculated Composition.	
Total acid and resin . .	= 17·7	Pseudaconitine .	16·2 × 4 = 64·8
Resin and pre-existing acid	= 1·3	Aconitine . .	0·2 × 6 = 1·2
		Water	= 4·2
	16·4	Pseudaconine, etc. (by difference) . . .	= 29·8
Benzoic acid	= 0·2		
Acid due to pseudaconitine	= 16·2		100·0
Loss at 100 . . .	= 4·2		

Probably the water present in this and the preceding specimen existed as a hydrate of pseudaconitine, the substance having been precipitated from aqueous solution by alkalies. The formula $C_{36}H_{49}NO_{11}.2H_2O$ requires 5·09 per cent. of water, so that substances containing 70·4 and 64·8 per cent. of pseudaconitine, as this hydrate, should also contain respectively 3·58 and 3·30 per cent of water.

This process for the quantitative examination of aconite alkaloids can, of course, only give correct results in the event of no other substances being present that will yield on saponification with water either benzoic or dimethylprotocatechuic acid. Experiments now in progress, however, seem to indicate that the amorphous comparatively inert base capable of yielding well crystallized salts obtained by Mr. Groves from one batch of *A. Napellus* roots (Base "A" of *Year-Book*, 1875, p. 514) is capable of also yielding benzoic acid on similar treatment. Should this prove to be the case, the determination of the amount of aconitine present by the above process will be incorrect, and the method must be modified in cases where the amount of benzoic acid yielding alkaloid present is at all considerable; a modification which appears to give results sufficiently satisfactory for practical purposes, consists in dissolving the alkaloid to be tested in dilute hydrochloric acid, and pouring the solution into sodium carbonate solution. By suitably regulating the strength of the solution, it is possible to get a tolerable separation of aconitine, and the other base (to which it is proposed to apply the term *Picraconitine*, on account of its bitter taste), the latter being readily soluble in excess of the reagent, the former but sparingly soluble. By then saponifying the precipitate and determining the benzoic acid thus produced, an estimate of the amount of aconitine present can be obtained; whilst the picraconitine can be deduced from the difference between the total benzoic acid formed and that thus obtained from the precipitated aconitine.

In the case of a crystallized salt of aconitine (more or less mixed with picraconitine) this method of separation has been found to answer fairly, and with a correction for the solubility of aconitine in sodium carbonate solution, still nearer approximations can be obtained. On these points experiments are in progress.

§ 5. CONCLUSIONS.

From the experiments just described, together with those detailed in the previous reports, and the results obtained previously by Groves, Duquesnel, Hübschmann, and others, the following conclusions may be drawn:—

1. *A. Napellus* roots as met with in commerce contain a highly active crystallizable alkaloid, furnishing readily crystallizable salts. This is distinguished as *Aconitine*, and is represented by the formula $C_{33}H_{43}NO_{12}$. In addition they contain more or less of another active alkaloid, crystallizable, but not readily yielding crystallized salts. This is distinguished as *Pseudaconitine*, and is represented by the formula $C_{36}H_{49}NO_{11}$. Moreover, they contain (or at least the extract of the roots does) more or less of the decomposition products, produced by the saponification of these bases in accordance with the reactions.

$$\underset{\text{Aconitine.}}{C_{33}H_{43}NO_{12}} + H_2O = \underset{\text{Benzoic Acid.}}{C_7H_6O_2} + \underset{\text{Aconine.}}{C_{26}H_{39}NO_{11}}$$

$$\underset{\text{Pseudaconitine.}}{C_{36}H_{49}NO_{11}} + H_2O = \underset{\text{Dimethylprotocatechuic Acid.}}{C_9H_{10}O_4} + \underset{\text{Pseudaconine.}}{C_{27}H_{41}NO_8}$$

And further, an alkaloid apparently non-crystalline, and yielding non-crystalline salts, and containing a higher carbon per centage than any of these other bases, is also present. This seems to be of little physiological potency.

One batch of roots worked up by Mr. Groves contained besides aconitine an entirely different base, not crystallizing itself, but giving well crystallized salts. This base is comparatively inactive, and its salts are bitter and produce no lip-tingling, whence the name *Picraconitine* is assigned to this base, its formula being $C_{31}H_{45}NO_{10}$.

2. *A. ferox* roots contain comparatively large quantities of *pseudaconitine* with a little *aconitine*, and an alkaloid apparently non-crystalline and yielding non-crystalline salts, and containing a higher carbon percentage than any of the other bases. Apparently this is not identical with the analogous body from *Aconitum Napellus*. The substance from which Von Planta deduced the formula $C_{30}H_{47}NO_7$ probably mainly consisted of this base.

3. *A. Lycoctonum* roots appear to contain both aconitine and pseudaconitine, the substances thence extracted by Hübschmann, and termed by him "acolyctine" and "lycoctonine," being apparently simply alteration and decomposition products of aconitine and pseudaconitine in a more or less pure state.

4. So-called "aconitine" of commerce is a mixture of true aconitine and pseudaconitine, with variable quantities of their alteration products, aconine and pseudaconine, and of the amorphous unnamed alkaloids above alluded to. The "napelline" found by Hübschmann in commercial "aconitine" having been found by that chemist to be identical with his "acolyctine," is doubtless simply one of these decomposition products, viz. aconine, in a more or less pure condition.

5. The processes in ordinary use for the isolation of commercial "aconitine," are such as must inevitably bring about a large loss of active alkaloids through the saponifying actions above alluded to. The products of these actions are apparently far less physiologically active than the parent bases. In order to diminish this loss, the process of M. Duquesnel (use of tartaric acid) is far preferable to the ordinary methods (employment of hydrochloric or sulphuric acid). The crude alkaloids can be readily purified by crystallization from ether and petroleum spirit. True aconitine, $C_{33}H_{43}NO_{12}$, should further be converted into a crystallized salt if perfect purity is re-

quired. Unless crystallization of the alkaloids be employed, the products obtained will contain (besides other impurities) more or less of the unnamed amorphous alkaloids of higher carbon percentage.

6. A method of assay applicable both to *A. Napellus* and *A. ferox* alkaloids has been arrived at, by which the amount of each physiologically active alkaloid present can be obtained with sufficient accuracy for practical purposes. It is probable that if manufacturers would supply an article at a constant strength (say 30 per cent., 50, 70, or the like), as determined by this process, complaints as to irregularity in the efficacy of commercial "aconitine" would cease, whilst so doing would in many cases render it unnecessary to purify by crystallization the crude alkaloid. If attempts are made to prepare only pure or approximately pure alkaloids, much waste will occur in the form of mother-liquors, uncrystallizable masses, retaining much of the active bases, etc. These, however, might readily be utilized for diluting to a fixed standard batches of the commercial article, which happen to be above the standard in the first instance.

7. From the ease with which both aconitine and pseudaconitine decompose by saponification, it seems extremely probable that *liquid* preparations, such as tinctures, will gradually lose activity on keeping. This must inevitably occur where the liquids are neutral or alkaline, and will probably occur to some extent when the alkaloids are kept in solution, as salts of organic acids, for lengthened periods.

8. Aconitine and pseudaconitine, although allied in physiological action and to some extent in chemical characters, do not seem, as far as experiments have as yet gone, to have a common nucleus or radical. They are allied, as regards their principal decompositions, to the opium alkaloids, narcotine, oxynarcotine, and narceine, which again are akin to the products obtained from the alkaloids morphine and codeine by treating them with the anhydrides of organic acids. From experiments now in progress, they appear also to be allied to veratrine; whilst the results of Kraut and of Lossen indicate a certain amount of analogy between aconitine, atropine, and cocaine, benzoic acid having been obtained by these chemists by the splitting up of the latter two bases.

The PRESIDENT suggested that the next paper, being on a similar subject, should be read, in order that both might be discussed together.

PRELIMINARY ACCOUNT OF THE ALKALOIDS FROM JAPANESE ACONITE.

By B. H. Paul, Ph.D., F.C.S.; and C. T. Kingzett, F.C.S.

This preliminary investigation was undertaken at the request of Mr. E. M. Holmes, who had been examining the structure of the particular roots which formed the subject of our studies.

The roots were known to be genuine, having been imported direct from Japan.

In our experiments 3940 grams (or 8·6 lbs.) were subjected to the process of M. Duquesnel.

The ground material was first extracted with cold benzoline. This extract on distillation left a dark liquid behind, from which ether in the presence of tartaric acid removed no alkaloid.

The root was then thoroughly extracted with cold alcohol containing 1 per cent. tartaric acid, and the extract distilled to a low bulk. Water was now added, and the mixture filtered from the fat-like precipitate and subjected to further treatment according to Duquesnel's method,* that is to say, it was extracted with ether in the presence of bicarbonate of sodium, and the alkaloid obtained in a crude state by distillation of the ether.

In this way, 7·17 grams of crude mixed alkaloids were obtained; a quantity equivalent to about 0·18 per cent., or 13 grains to the pound. Duquesnel obtained 0·06 to 0·4 per cent., and Wright from 0·03 to 0·07 per cent. in operating upon roots of *A. Napellus*.

The crude alkaloid obtained as described was somewhat coloured: from its ethereal solution needle-like crystals formed on standing. This crystalline substance presented the following characters:—

Very sparingly soluble in water.

Soluble in cold alcohol (65 per cent.).

Extremely soluble in dilute acids or water faintly acidified.

Not precipitable from aqueous solution by platinic chloride.

When converted into hydrochloride, however, platinic chloride gave a bulky precipitate soluble in cold spirit. When the platinum precipitate thus obtained was boiled in water, a part became viscid and fused, while another part dissolved and was reprecipitated on cooling.

On boiling for an hour with a very dilute solution of sulphuric acid, a solution was obtained which reduced Fehling's test.

The whole quantity was now several times recrystallized from

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* See *Pharm. Journ.* [3], ii., p. 226; vii., p. 1040.

ether, and then from warm dilute alcohol several times also, the latter recrystallizations being effected upon solutions which had been rendered practically colourless by animal charcoal. In the earlier recrystallizations a varnish-like substance was deposited upon the sides of the dish along with the crystals. From its greater solubility in the alcohol the crystals were ultimately obtained in a white state and free from this uncrystallized substance. As thus seen, no definite shape could be distinguished in the crystals; they were chiefly crystalline plates and needles, and less than 2 grams were ultimately obtained in a fit state for analysis. A part of this was finally recrystallized, washed with water, dried at 100° C. (without change of any sort), and analysed.

(*a*) 0·270 gram gave 0·623 gram CO_2 and 0·192 gram H_2O.
(*b*) 0·3135 gram gave 0·218 gram H_2O.
(*c*) 0·3230 gram gave 6·63 c.c. N normal, which required no correction.

Theory of $C_{29}H_{43}NO_9$		Found. Per cents.	+ At. Wgts.	+ N=1.
63·38	C	62·926	5·2439	28·6
7 83	H	(*a*) 7·900 (*b*) 7·726	7·900	43·1
2·55	N	2·567	·183	1·0
26·23	O	26·607	1·662	9·0

Having now obtained the base, we desired to compare it with other substances which have been described and which may be obtained commercially under the name of aconitine.

It is as unnecessary as it would be laborious to attempt a complete *résumé* of all that has been done and written about the aconite bases. The real knowledge possessed regarding them is very limited, and may be expressed very briefly. Doubtless, many of the substances which have formed the subjects of study by chemists have been mixtures or impure, hence it results that nearly every experimenter has arrived at a different formula for the base constituting in his opinion the primary one. Others have concluded that aconite yields two bases; while yet others believe that a whole series of closely related alkaloids are to be obtained from the various roots.

MM. Gréhant and Duquesnel* describe aconitine as a substance which crystallizes in rhombic or hexagonal plates having a composition represented by the formula $C_{27}H_{10}NO_{10}$. It is said to be very

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* *Pharm. Journ.* [3], vol. ii, p. 226.

soluble in alcohol, ether, benzine, and chloroform, while the acetate is described as highly crystallizable. In another communication,* Duquesnel has expressed the opinion that aconitine is a glucoside, but he does not give grounds for this belief. He further says that both glacial phosphoric acid and sulphuric acid give with the base a violet colour, and that the auric and platinic chloride combinations of the alkaloid are soluble in alcohol.

Groves has worked extensively with the alkaloids of aconite, and more recently Wright has subjected his products to ultimate analysis.

In one of his many papers,† Mr. Groves says that the aconitines of commerce are partly crystalline. Aconitine is described as giving a precipitate with platinic chloride, and a nitrate whose crystals consist of rhombic prisms with dihedral summits; the alkaloid is precipitated from the nitrate by means of ammonia.

In Germany ‡ a difference was recognised between the English and German preparations, and the existence of two alkaloids was assumed. The name aconitine was applied to the German alkaloid, while the names napelline, nepaline, acraconitine, pseudaconitine were given to the English preparation.

The German substance was said to be coloured violet by phosphoric acid when applied in the hot concentrated state. It was described as yielding no platinum salt (insoluble in water), while the English substance was said to give no colour reaction either with sulphuric acid or phosphoric acid. The English alkaloid was further described as being not very soluble in ether or alcohol, although its alcoholic solution was said to crystallize readily.

Flückiger, on the contrary, came to the conclusion that the English and German alkaloids were identical.

Stahlschmidt and Von Planta both give to aconitine the formula $C_{30}H_{47}NO_7$.

Wright, § in conjunction with Mr. Beckett, and subsequently alone, has submitted the subject of aconite alkaloids to a fresh investigation. Groves had obtained from *Aconitum ferox* a base regarded by him as peculiar to that species of root. It crystallized from ether, but yielded salts which would not crystallize. Wright analysed this, and gave to it the formula $C_{36}H_{49}NO_{11}$, and to the gold salt $C_{36}H_{49}NO_{11}.HCl.AuCl_3$. This alkaloid had been ex-

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* *Pharm. Journ.* [3], vol. ii., p. 602.

† *Pharm. Journ.* [2], vol. viii., p. 118. ‡ *Pharm. Journ.* [3], vol. i., p. 121.

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tracted by means of alcohol acidulated with hydrochloric acid and the extract had been evaporated down. Now, were any of the alkaloids thus extracted of the nature of glucosides this process would be a most effectual one for their decomposition into glucose and other bodies. How far, therefore, the body analysed by Wright is to be regarded as a primary constituent of *Aconitum ferox* it is difficult to decide.

A second product, also isolated by Mr. Groves, and obtained from *A. Napellus*, was converted from the nitrate by means of ammonia into the free base which crystallized from ether. This body contained 62·7 to 62·9 per cent. C., and 7·2 to 7·3 per cent. hydrogen; the nitrogen was not determined, but Wright first gave to it a formula $C_{32} H_{13} N O_{10}$, and then afterwards regarded it as an impure or altered body; not from a further examination of it, but from distinct results.

Wright rejects Duquesnel's formula, $C_{27} H_{40} N O_{10}$, as incorrect, and arising from an imperfect separation of the bases obtained from *A. Napellus*. He says repeated crystallizations do not suffice to separate the two, viz., aconitine, which is crystalline; and picraconitine, which dries up as a varnish.

Two bases are therefore recognised by Wright as existing in *A. Napellus*, viz., picraconitine, an uncrystallizable alkaloid, comparatively inert, yielding crystallizable salts (this often preponderates); and aconitine, which is crystalline, and whose salts are crystalline.

To picraconitine Wright assigns the formula $C_{31} H_{45} N O_{10}$, and he gives to its crystallizable hydrochloride that of $C_{31} H_{45} N O_{10} H Cl. 1\frac{1}{2} H_2 O$; a formula which is, in our opinion, inadmissible. In the analysis of the hydrochloride, Wright obtained more carbon than this theory requires, but less nitrogen; and with the exception of this one instance, Wright has not given nitrogen determinations. These are circumstances entirely opposed to general experience, and they suggest the suspicion that Wright's formula is incorrect. At the same time the free base appears to have yielded the theoretical percentage of carbon.

To get aconitine pure, Wright says it is necessary after recrystallizing it from ether to make a crystalline salt, preferably the hydrobromide, and to regenerate the base from this by sodic carbonate in the presence of ether. To pure crystallized aconitine, Wright gives the formula $C_{33} H_{13} N O_{12}$, but no nitrogen determinations are given, and several features are presented which raise doubt as to the correctness of this view. Thus, in an analysis of the "pure base" he obtained 61·71 per cent. carbon, against 61·39 required by theory.

In a further investigation, Wright followed Duquesnel's process, and confirmed the results of examination of his own preparations by comparison with those obtained with Mr. Groves' products; but, here again nitrogen determinations are entirely neglected, and this is really a serious consideration, from the fact that very different substances, capable alike of forming gold salts or hydrochlorides, may present similar precentages of carbon and hydrogen; and to reason that because the chlorine or the gold bears a certain atomic ratio to the carbon, therefore nitrogen bears a like atomic ratio to the carbon, is a most dangerous assumption. Above all things in importance is the relation of nitrogen to carbon in such compounds.

The numbers we obtained by analysis of the alkaloid from Japanese aconite agree best with the formula $C_{29} H_{43} N O_9$, and they are not comparable with those obtained by Wright for his crystallizable alkaloid (aconitine). Moreover, unlike the alkaloid he describes, the one we obtained gives no crystallizable salts, or, at least, none have been obtained, although many and various attempts were made to get them. The alkaloid was intensely bitter, and it gave, on boiling with dilute sulphuric acid, a solution which readily reduced Fehling's test. By way of comparison, German aconitine, French aconitine, and Morson's aconitine were similarly treated. The French and Morson's preparations behaved, in this respect, like ours, but the German preparation gave an absolutely negative result. These preparations also refused to yield crystalline salts; it is true the acetates, especially that of Morson's, showed signs of crystallization, but practically the hydrochlorides, nitrates, and acetates dried up to varnishes.

The free alkaloid prepared as described did not fuse or change colour at 100° C., nor did it fuse or agglomerate in any measure in the way presented by the other three preparations alluded to, when boiled in water.

The varnish-like substance which accompanied the crystalline substance has not been examined particularly, except that it has not been possible to obtain crystallizable salts from it. An interesting and important result, however, was obtained from an examination of the watery alcoholic mother-liquors left after the crystallization of the pure alkaloid, and containing this uncrystallizable substance. It was found that on addition of ammonia to the solution, a very bulky white precipitate was thrown down, having all the characters of the crystallizable alkaloid. From the very sparing solubility of that alkaloid in water it appeared that it must have existed in combination as a salt, and to test this the ammoniacal filtrate was evaporated to dryness. In this way there was obtained a gum-like mass, which dissolved in water and gave a bulky precipitate with lead acetate. containing when dried at 100° C., 50·82 per cent lead. As aconitine is supposed to exist in aconite roots, etc., in combination with aconitic acid ($C_6 H_6 O_6$), and since aconitic acid, as well as the alkaloid, is soluble in ether, it is conceivable that the compound would be extracted, at least partly, by Duquesnel's process. for it is not probable that tartaric acid would effect its decomposition. In such case some process like that of Sonnenschein's. employing phosphomolybdic acid, would have to be employed in order to obtain absolutely satisfactory evidence of the composition of the aconite alkaloid.

The question, therefore, arises whether many of the substances which have been analysed as aconitine were not really aconitate of aconitine. Pure aconitate of lead, represented by the formula $3\,Pb\,2\,(C_6 H_3 O_6).\,3\,H_2 O$, requires 61 per cent. lead. A further quantity of the lead salt alluded to above was obtained, washed, and decomposed with sulphuretted hydrogen. The filtrate had an acid reaction, and on evaporation to dryness left an acid gummy residue not unlike aconitic acid. On treating the French, German, and Morson's preparations by heating them to about 90° C. with water. a quantity was dissolved in each case. This was continued until ammonia no longer gave any precipitate with the filtrates, and on evaporation of the ammoniacal solutions, a substance was obtained in each case resembling the ammonium salt of aconitic acid.

To revert to the method of obtaining the alkaloids, it will be seen that the solution of acid tartrate was decomposed by sodic bicarbonate and the mixture extracted by ether. The alkaline solution remaining after this was rendered acid by nitric acid. and the solution fully precipitated by phosphomolybdic acid. A somewhat bulky precipitate was thus obtained; it was decomposed after washing with water acidulated with sulphuric acid, by means of baryta water, and the excess of this reagent removed by carbonic anhydride, the last traces being taken out exactly by very dilute sulphuric acid, which was added to neutrality. The dark coloured fluid thus obtained deposited only a viscid brownish mass on evaporation over sulphuric acid.

The solution had the following characters:—

It gave with ammonia no precipitate.

It gave with potash a bulky precipitate.

It gave with a solution of mercuric chloride in excess of potassic iodide, a bulky precipitate.

It gave with a watery solution of iodine, a precipitate.

When acidified slightly with hydrochloric acid, platinic chloride gave a small precipitate, soluble in alcohol, and containing about 28 per cent. platinum.

Although these characters are not distinctive, they at least indicate the presence of an alkaloid capable of isolation in the manner described. After the precipitation by platinum, the bulk of the substance was left in solution.

In recapitulation of the results above described, it may be said that the Japanese aconite examined by us has yielded a crystallizable alkaloid of the formula $C_{29} H_{43} N O_9$, which does not give crystallizable salts; a further substance, which behaves as a salt of the crystalline alkaloid, but is itself uncrystallizable; from which it appears that a certain part at least of the alkaloid is in combination (as extracted by Duquesnel's process) with an acid, perhaps aconitic; moreover, Duquesnel's process does not extract all the alkaloidal matters from aconite root.

The President said these were two papers on a very important subject, by gentlemen who could hardly be surpassed either in their knowledge of the subject or power of working it out; and one or two points presented themselves in connection with it. They had been accustomed for many years to look to the extraction of the active principles, the alkaloids especially, which were found in the vegetable kingdom, which possessed, as a rule, very powerful and often valuable medicinal properties, and to their use either in an isolated state or in a subsequently artificially combined state, as affording the best if not the only security for anything like uniformity in the preparations administered. The results now brought forward, however, rather tended to weaken the feeling of confidence hitherto reposed in the use of these active principles in their isolated condition. It appeared with reference to aconitine, that in the very process of isolation it was subject to very material changes; that a body which was one of the most powerful poisons known to the medical profession, a small fraction of a grain of which would produce death under the most painful circumstances, was liable even by the mere action of heated water to split up, yielding a product which was inert; and that by various chemical actions, to which the body was necessarily subjected in its production, a variety of products more or less inactive were produced. It certainly appeared that the aconitine which had been used in medicine hitherto had never been the pure aconitine in an unmixed condition; and many medical men were perfectly aware of this fact. He recollected hearing the late Mr. Morson—who was a manufacturer of aconitine and who made it, he believed, for the physician who first introduced it in medicine in this country—say, that he had known that gentleman come into his establishment and when shown a specimen of foreign made aconitine, fearlessly taste it, so convinced was he of its want of energy. Fortunately, this substance was rarely if ever used internally, but only externally; still it was a serious consideration that they were constantly using a body of this description, so powerfully poisonous, but which so readily underwent change that there was great difficulty in obtaining it in a state of purity. He would now invite discussion on these valuable papers.

Mr. HOLMES said there were only three species of aconite at present known to occur in Japan: *A. Lycoctonum*, L., *A. Fischeri*, Reich., and *A. uncinatum*, L. The root received in commerce appeared to consist in large measure of one kind only, which Mr. Greenish had lately examined for him, and it appeared to possess a very different structure from the ordinary *A. Napellus*, and the root itself certainly was much stronger in taste. Dr. Paul had called attention to some of the specimens having a horny or resinous appearance, while the majority were starchy; but the same feature appeared in *A. ferox*, and was probably due to the drying or some other cause with which they were not acquainted, rather than to any difference in species. One source of difficulty in dealing with this subject was that it was almost impossible in commerce to get specimens of one kind of root only, and therefore it was necessary to be very careful in speaking of results. The German aconite consisted chiefly of two species—the *A. Napellus* and *A. Stoerckunum*. In the case of the Japanese aconite of commerce they had no certain knowledge that more than one species did not occur, and the varying results obtained by analysis might therefore be owing to the presence of different species of root; and until one species exclusively was cultivated in this country, so that it might be thoroughly examined, it was impossible to come to any definite conclusion with regard to the alkaloids of any one species.

Mr. J. F. WALKER asked whether the compound in which the benzoic radical replaced hydrogen in pseudaconine had been obtained?

Dr. WRIGHT replied not yet. This was only a preparatory report.

Mr. GREENISH said that having been for some time engaged in the microscopic examination of aconite roots, he had found that those imported were always more or less mixed, no matter whether they came from Germany or elsewhere. With regard to the Japan aconite, there were certainly two roots; he could not say of two different species, but one was a very tuberous root, evidently a young one, and another was longer and shrivelled, being older. Dr. Paul had made a remark that the root was very starchy; and a transverse section of the tuberous root showed this. And when the starch was removed, there was nothing left but a clean, clear, cellular tissue, with the fibrovascular bundles. In the case of the shrivelled root the cellular tissue had upon it a deposit of a resinous character; and having been accustomed now and then to put a section into his mouth when cutting, he had arrived at the conclusion that the tuberous root, which formed by far the largest proportion of the Japan aconite, did not contain so much of the pungent principle as the older and longer root. The Japan species was certainly not, in his opinion, *A. Napellus*, the histological character being quite different. It had generally a much larger number of fibrovascular bundles in a transverse section than *A. Napellus*. It seemed to him clear that pharmacists could never make preparations of a definite strength until they knew in the first place the relative proportions of young roots as compared with old ones, and whether they were all of one species; and secondly, whether the root in Japan was cultivated or not, because the cultivation of the aconite certainly diminished its active properties.

Mr. UMNEY said it would be very useful if it could be elicited which of the aconites was most powerful. In commerce, large parcels of Japan aconite were occasionally to be met with; sometimes parcels of the large root known as Nepaul aconite (*Aconitum ferox*) were offered for sale, while German aconite root was generally obtainable. All these were used in the manufacture of preparations which were used internally, as well as for liniments. His own impression was that the Nepaul aconite was the strongest. The men employed in crushing the roots in drug mills complained very much of the Japan root as causing a very powerful tingling sensation.

Mr. GREENISH did not think this effect was so much due to the greater intrinsic strength as to the starchy character of the root, which would cause it to be diffused in the atmosphere. The starchy matter of *A. ferox* was converted probably by the heat in the process of drying into dextrine, and, therefore, when this root was crushed, it did not diffuse in the atmosphere.

Mr. GERRARD said he agreed with what was stated in Dr. Paul's paper, that the amount of the alkaloid contained in the Japanese aconite was far beyond that given by Duquesnel and Dr. Wright, and that he himself had also obtained another substance with the nature of which he was not acquainted. On the addition of caustic lime and the removal of the precipitated alkaloid by ether, and the addition of carbonate of potash, an alkaline precipitate was obtained which did not crystallize from its solution in ether. With reference to the different strength of preparations of aconite, the liniment made from the Japanese variety was certainly not admissible, by the side of that made from the ordinary aconite root of commerce, for it was double the strength and caused intense irritation when applied externally. In fact, when working with it, it was necessary to envelop the face with some kind of gauze in order to prevent ill effects, and severe numbness of the hands had been caused by contact with the powdered root mixed with spirit.

Professor ATTFIELD agreed with the President that the present condition of pharmacists in relation to aconite had been shown by recent investigations to be a very foggy one; but if so, their previous condition was one of mere chaos; and it might be expected that when more light was thrown on the matter by the very luminous constellation forming the Committee, they might so clearly see their way as not only to be able to prepare aconitine most satisfactorily, but also how best to make the different galenical preparations of aconite. He should therefore be glad to hear from Dr. Wright whether he considered the investigation was one to which the Conference might usefully make a further grant.

Mr. KINGZETT said Dr. Wright, in his researches on the aconitines, seemed to have arrived at the conclusion that there were three distinct alkaloids, the first in importance being aconitine, $C_{33} H_{43} N O_{12}$, which is crystalline and gives crystallizable salts; the second alkaloid being picraconitine, $C_{31} H_{45} N O_{10}$, itself non-crystalline, but furnishing crystalline salts; and pseudaconitine, $C_{36} H_{49} N O_{11}$, said to be crystalline, but yielding salts which dry up to varnishes. In contrast with these results, the alkaloid obtained by Dr. Paul and the speaker was crystallizable; its salts, however, were uncrystallizable, and its formula $C_{29} H_{43} N O_9$. Now, among other extraordinary matters, Dr. Wright had assigned* to the hydrochloride of picraconitine the formula $C_{31} H_{45} N O_{10}. H Cl. 1\frac{1}{2} H_2 O$. He (Mr. Kingzett) contested that such a formula was incompatible with our present ideas of chemistry; the molecule of an organic body could not be associated with one and a half molecules of water. On the other hand, Dr. Wright had stated that a similar molecule of picraconitine

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* *Journal of the Chemical Society*, February, 1877.

combined with one of auric chloride. Taking these two points into consideration, Mr. Kingzett could not accept the formula given to picraconitine by Dr. Wright, and he was equally suspicious of those assigned to aconitine and pseudaconitine. To take Dr. Wright's own analytical numbers, it would be seen that the carbon estimations were for the most part too high, while in as many instances the hydrogen figures were too low for the theories against which Dr. Wright compared them; and as these experiences in organic analysis were the reverse of those usually obtained, either the analytical numbers or Dr. Wright's theories must be rejected. Further, Dr. Wright did not give nitrogen determinations except in one case, while the number of carbon atoms in the molecule had been determined by a consideration either of the number of chlorine atoms, or of gold salts, which were not safe to deal with, as the gold might be either too high or too low. The chlorines could not be trusted because there might be half a dozen bodies in mixture, each of which might have the power of combining with one HCl. The only reliable factor, therefore, in determining the molecule of the base, was the relation of the nitrogen to the carbon, and this method Dr. Wright had not adopted, except in one instance. This had been done, however, by Dr. Paul and the speaker in the case of the base from Japanese aconite having the formula $C_{29} H_{43} N O_9$, and therefore there could be no doubt that it differed in its properties from anything described by Dr. Wright. As had been mentioned, in the mother-liquor was found a substance that gave a precipitate on adding ammonia, and from this it was conjectured that it was a saline compound with an acid which formed an ammonium salt when the base was thus set free, and they had no doubt at all that this precipitated base was identical with the crystalline alkaloid already alluded to. With regard to Mr. Gerrard's view as to the extraction of the bicarbonate of sodium solution by ether, he remarked that by applying Sonnenschein's process to that solution, a third quantity of base was obtained, a platinum salt of which had been analysed; but the analysis was not completed, nor was the examination of the base generally completed, so that they had reserved further mention of it to a future opportunity.

Dr. Wright was very glad to find that the Japanese alkaloids had been examined. The Committee appointed by the Conference to investigate this subject made several endeavours to obtain specimens of this root, but failed to do so; and he regretted that the authors of the second paper had not thought fit to mention what they were doing to the Committee, or perhaps they might have been saved from falling into one or two trifling errors. In the first place, the description given of the alkaloid to which the C_{29} formula was given was quite sufficient to convince him that the body in question was simply the same as he had had in his hands dozens of times, viz., a mixture of pseudaconitine and the decomposition products thereof. The analytical numbers exactly agreed, and so did the physical characters; and he had no doubt that when Dr. Paul and Mr. Kingzett tried the experiment of fusing up some of the acid or resinous mother-liquor with caustic potash at a temperature of about 250°, and then acidified, and extracted with ether, they would obtain protocatechuic acid formed from the dimethylprotocatechuic acid. If you s'arted with perfectly pure pseudaconitine and crystallized it from alcohol, you would get a mother-liquor which only required acidifying and shaking up with ether to yield this body. The alkaloid which crystallized out was the pseudaconitine in a tolerable state of purity, although it partially decomposed even while drying. The gummy mother-liquor that dried up to a resin was a mixture of the alkaloids themselves, viz., pseudaconitine and pseudaconine, and the dimethylprotocatechuates of each of these two bases, and, therefore, it was no wonder that on regenerating the alkaloid from this resinous mass it was found to possess exactly the same properties as the substance which did crystallize from alcohol, viz., the same mixture of the same two bases. From the short time at his disposal he had not described a considerable number of experiments which really showed that exactly the same bodies were obtained as those described by Dr. Paul and Mr. Kingzett. The body which Mr. Gerrard described as being obtained from the mother liquor he had no doubt was pseudaconine, which was retained in solution much more readily in alkalies than pseudaconitine or aconitine. He should also mention that the aconine, the decomposition product of aconitine, was soluble in water and precipitated lead acetate, so that it might be quite possible that the body experimented on by Dr. Paul might have contained aconitine itself in addition to the dimethylprotocatechuates. Mr. Kingzett had referred to the improbability of a body containing one and a half molecules of water of crystallization; but, as a matter of fact, a large number of such instances were known, and if that was the only difficulty it was very easy to double the formulæ, as he had advocated in the case of other alkaloids. As regards the question why the nitrogen was not determined in order to get at a ratio between the carbon and the nitrogen, except in one or two instances, he regarded this determination as eminently more fallacious than any you could make in organic chemistry

You could get a fair approximation to the nitrogen, and an almost exact one of the carbon, but whichever method of determining the nitrogen you employed, there was a liability to so many errors that the question whether the ratio was one of nitrogen to thirty of carbon or one to thirty-one was impossible to decide by the soda lime or any other method. That was the result of many observations on the subject. In reply to Dr. Attfield's question, whether he thought a further grant might be usefully expended in solving some part of the pharmaceutical aspect of the question, he must say that in his opinion if the balance which remained in hand of the former grant were re-granted, some results might accrue which might be sufficiently interesting to warrant the expenditure. At any rate he should like to complete the investigation in which he was associated with Mr. Groves and Mr. Williams, and even if no further grant were made, he proposed carrying it out as far as the materials he had in hand would permit. A question had been asked whether any observations had been made on the comparative activities of the different aconite roots and the alkaloids thence derived. If his memory served him, some specimens of pseudaconitine and nearly pure aconitine, isolated some years ago by Mr. Groves, were examined by Dr. Fraser of Edinburgh, but he did not remember the precise character of the results, nor was he sure whether he was not confusing them with those obtained by a German chemist from the same two alkaloids; but it was found that whilst aconitine was considerably more active than pseudaconitine with certain animals, such as rabbits, it was less energetic with others, such as guinea pigs; so that the physiological ratio of activity would be different according to the kind of animal experimented on, and very possibly might be different with different individuals of the human species. He had not been able hitherto to carry out any physiological experiments on these substances, because he was waiting to get one or two other bodies in a state of perfect purity, and moreover he did not possess a vivisection licence. He hoped, however, that before the next Conference the physiological activity of all the specimens yet obtained would be carfully examined side by side, by Professor Michael Foster of Cambridge, who was willing, he believed, to undertake this examination. With regard to the pharmaceutical aspect of the question, he did not think the preparations made direct from the root without the isolation of the alkaloids could be at all relied on. In the first place, in an alcoholic solution even the organic salts of the aconite alkaloids would undergo decomposition slowly on keeping. and therefore a preparation of a certain potency now would be weaker next year; and again, the roots met with in commerce were probably derived from different species grown in different climates and soils, and probably therefore contained different amounts of active alkaloids; so that a preparation made in one case with a certain weight of one class of root would differ from one made from the same weight of another class. If, however, the alkaloids were extracted to a certain degree of purity, say fifty per cent., you could always depend on having an agent of the same physiological potency.

Mr. KINGZETT said the discussion of course could not go on indefinitely, but he should like to make one or two remarks on what had fallen from Dr. Wright. In the first place it was generally accepted by chemists that the method of Dumas was an exact method for determining nitrogen; the error being generally on the side of excess to a slight degree, but when corrected in the ordinary way the error was reduced practically to nothing: whilst by the soda lime method you were liable to get a very large error indeed, and it was by this method that Dr. Wright had made his solitary nitrogen estimation. It had been shown by Dr. Thudichum and Mr. Wanklyn, and more recently by Dr. Thudichum and himself, that the methods he had mentioned were exact; he (Mr. Kingzett) had made more than 500 analyses, in which correct nitrogen determinations had been so effected. Dr. Wright imagined that the alkaloid they had obtained was his pseudaconitine mixed with what he supposed to be the aconitine decomposition product; but there was not the least evidence for such a statement, as he should now show. There might be in different species of aconite root different alkaloids, but that the alkaloid obtained from Japanese aconite was identical with any of the alkaloids described by Dr. Wright was perfectly inadmissible. Dr. Wright had stated that while hydrochloric acid and certain other reagents split up these alkaloids into certain decomposition products, tartaric acid was free from this objection; yet, nevertheless it was by a method employing hydrochloric acid that Dr. Wright had obtained his pseudaconitine! On the other hand, Dr. Paul and he had used tartaric acid, and therefore on Dr. Wright's own showing the Japanese alkaloid could not have been at least a mixture of pseudaconitine with aconitine decomposition products. Not only so, but their alkaloid, with the formula $C_{29} H_{43} N O_9$, did not split up as stated by Dr. Wright to be true of his substances either into benzoic or dimethylprotocatechuic acid and secondary bases, so that all this theory as applied to their alkaloid was the merest imagination. They had noticed that both the French and English commercial aconitines, as well as that which they had prepared from

Japanese aconite, when boiled with dilute sulphuric acid (a 2 per cent. solution), yielded a solution which would reduce Fehling's copper test, and in that respect it resembled sugar; but he was not prepared to accept that circumstance as a proof that it was dimethylprotocatechuic acid, especially on the evidence contained in Dr. Wright's paper. He should also remark that the alkaloid from the German aconite failed to give this reaction when boiled with dilute acid. Lastly, he should like to ask Dr. Wright what were the physical characters of the acid obtained by splitting up in the way he described, of aconitine by dilute acids, alcohol, and so on.

Dr. Wright said the physical characters of benzoic acid were pretty well known; the melting point was 120·5; it was slightly volatile, and it yielded various characteristic reactions. The other acid was somewhat analogous in its properties; it was extracted from an aqueous solution by ether, almost entirely by one extraction—perfectly by three; the ethereal solution left by evaporation a residue which could be crystallized from boiling water, the substance being nearly insoluble in cold water. He had tested it side by side with synthetically prepared dimethylprotocatechuic acid, and found they were identical. The neutral salts of each of these acids gave with a moderately strong solution of nitrate of silver, a peculiar gelatinous precipitate, and there were several other qualitative tests in which the two bodies absolutely agreed.

Dr. Paul said it would be unreasonable to detain the meeting with the discussion of a subject which was unfortunately in a very incomplete and inchoate condition, but he should like to say just a word or two. The fact that the examination of the alkaloid from the Japanese aconite had been undertaken by himself and Mr. Kingzett had incidentally brought them in contact with the subject on which the report had been read. Having obtained the alkaloid and examined the substance to some extent, they supposed, after the amount of elaborate investigation and reporting which had gone forward for some time, they had merely to do as a botanist did with some questionable plant—compare it with one in his herbarium—and that then they would be able to say whether it was picraconitine, pseudaconitine, or something else described in those reports. But when they came to apply this procedure to the substance in question they found themselves in such a fog that they were unable to say whether it was this, that, or the other, and in pursuing their way through this misty region they found only statements unsupported by any adequate evidence, and chemical formulæ that had no legs to stand upon; they had therefore to try and find some light for themselves. Just at the end of their journey they lit upon a fact which seemed to throw some light on the muddle and diversity of opinion which had prevailed with regard to the chemistry of aconitine. There was this much certain, that there had been a great variety and antagonism of opinion on the subject, and they all knew that aconitine varied very much. Makers would recommend their preparation as being more active than some one else's, and it was also agreed on all hands that the alkaloid obtained from aconite contained a crystallizable substance mixed with a gummy uncrystallizable substance. This agreed with the result of their examination of Japanese aconitine, and the samples of aconitine they had dealt with also contained an uncrystallizable substance, which together with the crystallizable portion was soluble in ether. A further examination showed that this gummy substance when treated with ammonia—not with strong alkalies, which they had avoided, having respect to the tradition that aconitine was a very evanescent substance—yielded an alkaloid identical with the crystallizable body in all its characters which they were able to test it by. The conclusion, therefore, at which they arrived was, that they doubted whether the alkaloid to which the active properties of aconite root are ascribed had ever yet been obtained in a separate state. In fact, it seemed probable that the substance extracted from aconite was to a great extent a salt of an acid like aconitic acid. In regard to the formulæ of the decomposition products which had been spoken of, he thought before they could say much about them they must determine clearly the nature of the substance from which they are supposed to be derived, whether it was really an alkaloid or whether it was a mixture of several accidental combinations of an alkaloid with some acid which might probably be aconitic acid, for that acid was certainly present in aconite, and since it was soluble in ether it would, therefore, certainly be got out by Duquesnel's process together with the alkaloid. With regard to the strength of the pharmaceutical preparations made from aconites, he would also remark that in the absence of more definite chemical knowledge of the active principle in aconites it was quite an accident what amount of potency these preparations would possess. The statements given as to the percentage of aconitine in aconite varied from ·03 to ·07, but they had obtained from Japanese aconite as much as ·20. Considering the powerful action of aconite it seemed desirable to have some means of determining the amount of active principle.

A vote of thanks having been passed to the authors of the papers, the Conference adjourned for luncheon, which was provided by the Local Committee in the Mechanics' Institute.

The PRESIDENT took the chair again at two o'clock, when the first paper read was a—

REPORT ON THE ACTIVE PRINCIPLE OF CAYENNE PEPPER.

BY J. C. THRESH.

In November last I received from Messrs. Hopkin & Williams, 8½lbs. of alcoholic extract of cayenne, obtained from 30lbs. of the fruit. This extract had separated into an upper fatty layer and a lower one containing but little fat.

By treating the whole with benzine and evaporating, 2¼lbs. of a deep red fat was obtained. This was dissolved in warm petroleum and left for a few days, at the end of which time it was found to have deposited a large quantity of a crystalline fat. This was removed and pressed, and after repeated crystallizations first from petroleum, and afterwards from spirit, a colourless, solid fatty acid was obtained, soluble in ether, alcohol, etc. Melting point 62° C. When burnt no acrid vapours were evolved. These and other reactions show that this substance is palmitic acid, and it probably constitutes the greater part of the cayenne fat.

The petroleum solution from which the palmitic acid had been removed was treated repeatedly with dilute alcohol to remove the capsaicin. The process proved on the large scale extremely tedious and unsatisfactory, since I only succeeded in obtaining from three to four drams of the active principle. This, however, is probably partly due to the comparatively small amount of capsaicin in the original fats. I have examined the fat obtained from various peppers, and find that by the same process very varying amounts of capsaicin are obtainable. The capsaicin thus obtained retained obstinately a trace of colouring matter, but by crystallization from ether I obtained about one dram of what I believe to be the absolutely pure principle.

·356 gram burnt with lead chromate gave ·9105 CO_2 and ·2995 H_2O.

·381 gram gave ·8745 CO_2 and ·318 H_2O.

From these the calculated percentages are :—

	I.	II.
C	69·74	70·26
H	9·3	9·28
O	20·96	20·46

These results agree fairly well with the formula $C_6H_{14}O_2$, obtained by Dr. Buri from a small portion of the capsaicin which had been obtained from Natal pepper. As a microscopical examination of this pepper led me to infer that it was yielded by a different species of capsicum, I was anxious to discover whether the principles of both were identical. So far as I have observed this is the case. The disappointingly small quantity of capsaicin obtained has not enabled me to advance much further in my investigation. In fact, it is almost useless to attempt this until some process is devised whereby it may be obtained more readily and in large proportions.

Oxidised with nitric acid, at least four products are obtainable; oxalic and succinic acids, an almost insoluble crystalline acid, and an oily body. Neither of the latter were obtainable in sufficient quantity for further examination.

Treated with dry chlorine, the crystals of capsaicin assume a deliquescent appearance, then gradually darken in colour, a tenacious dark brown resinous substitution product being ultimately obtained. During the reaction hydrochloric acid is evolved. It is probable that more than one product is formed. I have not succeeded in obtaining a crystalline chlorine compound.

Capsaicin forms crystalline compounds with barium, calcium, and mercury, but the difficulty lies in getting them free from uncombined capsaicin. The combustion of the barium and calcium compounds gave discordant results.

The colouring matter of cayenne fat, traces of which sometimes adhere obstinately to the active principle, is easily obtained from the marc left when the pepper has been thoroughly exhausted by spirit. This marc percolated with benzine yields an orange red solution, and upon evaporation a deep orange red oil. It is insoluble in proof spirit, slightly tints rectified spirit, and is only slightly soluble in boiling alcohol. An alcoholic solution of palmitic acid, capsaicin, or castor oil, takes up a considerable portion. It dissolves readily in oils, sulphide of carbon, petroleum, ether, amyl alcohol, and chloroform; from solution in the latter fluids it is precipitated by dilution with alcohol. Strong sulphuric acid turns it first indigo blue, then black.

Nitric acid strikes a blue colour, changing first to green, and becoming ultimately brown.

Hydrochloric acid does not affect it.

All oxidising agents convert it into a brown fatty matter.

Exposed to the air the colour slowly fades, and an indistinctly crystalline fat is deposited.

Mr. Williams said the extract forwarded to Mr. Thresh was not made by his firm, but by Messrs. Wright, Layman, & Umney.

Mr. Umney said he had experienced great difficulty in getting the oleoresin of capsicum in an uniform condition, there being generally a separation of the fatty matter; and it seemed to him Mr. Thresh had fairly elucidated the cause of its separation. The oleoresin was not of the same kind as was found in ginger, which was perfectly uniform and fairly homogeneous. The yield of crude capsicin from capsicums was enormous, as much as 20 or 25 per cent., whilst the oleoresin obtained from ginger was only about 10 per cent.

Mr. Greenish asked if Mr. Umney could tell what capsicum this was obtained from, as there were several kinds known. One, which was very much sold in this country ground for giving to canary birds, came from Natal, but on examination he found it agreed with the Nepaul capsicum.

Mr. Umney said the official chillies (*Capsicum fastigiatum*) only were used, and not those of *Capsicum annurum*, nor the Nepau cayenne pepper of commerce.

Mr. Gerrard said he had at the request of Mr. Thresh asked Professor Ringer of University College to make some experiments on the physiological action of capsaicin, but when given internally it produced such violent griping pain and purgative effect that he was obliged to discontinue its use.

Professor Attfield remarked that it was interesting to find that free palmitic acid was obtained from the capsicum. Of course there were other substances that yielded free fatty acids and acid glycerides, such as cocculus and cantharides, but the number was not great.

Mr. Benger asked in what doses the capsicin was given as described by Mr. Gerrard.

Mr. Gerrard replied in $\frac{1}{25}$th of a grain.

The President said it was necessary to distinguish carefully between two terms which had been used, namely, capsicin, used by Mr. Umney, which was the oleoresin yielded in abundance from the capsicum, and the capsaicin described by Mr. Thresh, which appeared to be a powerful body only obtainable in very small quantities. This latter body he presumed was almost too powerful for advantageous use in medicine, and indeed there seemed little object in seeking for a concentrated active principle, seeing that the capsicum itself yielded its active matter readily in a sufficiently concentrated state to admit of any medical application that might be required. He did not see that any very practical results were likely to follow this investigation, although it was of course desirable that they should know as much as possible of all the proximate constituents of substances used in medicine. He had himself for many years had experience of what Mr. Umney described as capsicin, which had been used to some extent in making what was known as soluble cayenne pepper, which was common salt mixed with the oleoresin and coloured if necessary with anotta.

Mr. Groves asked if the experiments alluded to by Mr. Gerrard included the application of capsaicin to the skin as a vesicant.

Mr. Gerrard said a solution of it in glycerin and weak alcohol was applied externally, and produced the same local effect as tincture of capsicum; there was more redness and severe heat, but no blistering.

Mr. Atkins said it would be a matter of practical interest to know if there was any improvement suggested in the menstruum which could be adopted for the use of this article as an external application. It was pretty well known to chemists that some vesicating papers were prepared with an extractive principle of capsicum.

Mr. Gerrard remarked, that as far as he knew, no vesicating paper was made from capsicum or any of its preparations. Cooper's sinapine tissue was, he believed, made from capsicin, but it was not a vesicant.

Mr. Manby (Southampton) said he had had considerable experience, both with mustard leaves and with Cooper's sinapine tissue, and he understood that the latter produced a more satisfactory result than the former, but without so much irritation.

Mr. Greenish confirmed what had been stated by Mr. Gerrard, that the mustard paper did not contain any vesicating principle except that of mustard.

A vote of thanks having been passed to Mr. Thresh, the next paper read was on—

ESSENTIAL OILS, WITH SPECIAL REFERENCE TO THE HYDROCARBONS CONTAINED IN THEM.

By William A. Tilden, D.Sc., Lond., etc.

For some time past I have been engaged in experiments upon certain essential oils, in the hope of being able to throw some light upon the chemical constitution of the hydrocarbons of the terpene family, which, as is well known, exist in a great many of the volatile oils obtained from plants.* In the course of these researches, however, I have naturally been led to examine, more or less closely, some of the other hydrocarbons and oxidised bodies which accompany the terpenes, and which in many cases contribute very materially to the peculiar characteristics of the essential oil.

The process I have chiefly employed for the identification and classification of the terpenes is based upon a reaction discovered by myself, and of which the first account was published in the *Journal of the Chemical Society* for June, 1875. It consists in passing nitrosyl chloride gas ($NOCl$) into the terpene, either pure or diluted with chloroform or alcohol, according to circumstances, and cooled to about $-10°$ C. by a freezing mixture. A white crystalline body is deposited, which always has the formula $C_{10}H_{16}NOCl$, and is therefore made up of a molecule of the terpene with a molecule of nitrosyl chloride. From this compound, by treatment with alcoholic potash, or by cautious heating, the elements of hydrochloric acid may be removed, and the substitution product, $C_{10}H_{15}(NO)$, obtained. These nitroso-compounds are easily obtainable in large crystals, and, by their crystalline form, melting point, and optical characters, they serve to determine the character of the terpenes from which they have been derived.

It is necessary here to remark that the name terpene must be carefully restricted to compounds of formula $C_{10}H_{16}$, and must not be extended to the polymeric hydrocarbons, $C_{15}H_{24}$ and $C_{20}H_{32}$, into which the terpenes are easily converted by heat or by the action of energetic chemical agents, such as sulphuric acid. I find that the reaction to which I have referred occurs only with the true terpenes ($C_{10}H_{16}$) and not with their polymerides. As further indicating difference of structure in these two classes of bodies, it may be remembered that Mr. Kingzett in his interesting experiments on the atmospheric oxidation of essential oils found that the C_{10} compounds gave peroxide of hydrogen, whilst C_{15} hydrocarbons did not.

Turpentine Oils.—At present I have examined closely only two of the different varieties of turpentine oil met with in European commerce, namely, the American and the French.

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* I cannot allow the present opportunity to pass without expressing my sense of the obligation I am under to Messrs. Schacht & Towerzey, of Clifton, for their liberality in supplying to me at cost price all the essential oils used in the latter part of the work. The grant of money that was entrusted to me by the Conference last year has thus been rendered more fully serviceable than would otherwise have been possible.—W. A. T.

American turpentine oil is obtained chiefly from *Pinus australis* and *P. Tæda*, and is the kind which is principally employed in this country.

The commercial samples I have examined gave generally about 80 per cent. of nearly pure terpene (australene), boiling at 156° to 159°. The distilled hydrocarbon varies slightly in its action upon a ray of polarized light. 100 mm. gave me in one case a rotation of 15°, in another 13° 18′ to the right.*

French or Bordeaux turpentine oil is the product chiefly of *Pinus maritima*, and is distinguished from American oil by its optical characters. It consists principally of a hydrocarbon (terebenthene) which boils at the same temperature as australene, but rotates the polarized ray to the left. 100 mm. gave me a rotation of − 33° 49′.

The nitroso-derivatives of these two hydrocarbons agree in composition, in solubility, and in melting point, also in forming crystals which not only belong to the same (monoclinic) system, but have the same crystallographic elements. The appearance is, however, quite different in the two crystals, so that once seen they are readily distinguished from each other, and recognised even when quite small. The measurement of these crystals is in the able hands of Professor N. S. Maskelyne, and his observations will shortly be published.

Both American and French turpentine oils, when mixed with spirit and nitric acid according to Wiggers' process, yield crystals of hydrated terpin, $C_{10} H_{20} O_2 H_2 O$. These crystals are rhombic, are generally four-sided prisms terminated by pyramids.

Whether obtained from right or left-handed turpentine oil, their corresponding angles are equal.

I am indebted to Dr. Armstrong for a specimen of Russian turpentine oil, which distils chiefly between 168° and 180°. According to Hanbury and Flückiger, Russian turpentine is the produce of *Pinus sylvestris*. Now, if this is the case, it is probably identical with Swedish turpentine oil, and this substance has quite recently been examined by A. Atterberg (*Deut. Chem.-Ges. Ber.*, x., 1202). According to this chemist there are two terpenes in this turpentine, one boiling at 156·5° to 157·5°, and dextro-rotatory, but to a greater degree than Berthelot's australene. The other terpene, which Atterberg calls sylvestrene, boils at 173°–175°, and does not agree

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* All determinations of rotary power made in the course of this work were performed with a Wild's polaristrobometer, using monochromatic light from a Bunsen flame, coloured by common salt and borax.

with any already known terpene. Its specific rotatory power is + 19·5°. I am sorry to say I have not yet prepared the nitroso-compounds from my Russian turpentine, so that I cannot say in what way the terpenes contained in it are related to others that I have examined.

Juniper Oil.—English oil of juniper (*Juniperus communis*), gave about one-third of its bulk below 160°. This liquid is almost inactive upon the polarized ray. 100 mm. gave a rotation of about 1° to the left. The nitroso-compound crystallizes in precisely the same manner as the corresponding compound from French turpentine, and in all other respects agrees with it completely. The other constituents of oil of juniper seem to be similar to those of turpentine oil; that is to say, they consist chiefly of hydrocarbons which are polymeric with the terpene, and boil at 180° and upwards.

Sage Oil.—Mr. M. M. Pattison Muir placed at my disposal small quantities of two liquids obtained by fractional distillation from this oil. As he will himself give an account of this essential oil, it is only necessary to mention here that one of these liquids has the same boiling point as terebenthene, and very nearly the same optical characters. It also yields a nitroso-derivative, $C_{10} H_{15} N O$, which is identical with that obtained from French turpentine oil.

These terpenes from turpentine, juniper, and sage oils, I regard as allotropic modifications of the same substance, since they agree in all respects except in the optical properties of the liquid hydrocarbon, and in the slight peculiarity of the crystals of the nitroso-derivative.

Oil of Savin (*Juniperus Sabina*).—The English oil was used, and the sample operated upon was believed to be perfectly genuine. According to the books, including "Pharmacographia," this oil is represented as having the same composition as oil of turpentine. Considering that savin is a coniferous plant, closely allied with the juniper, and most of the coniferæ yield volatile oils of the same general character, it is not unnatural to expect that this would be the case. So far as my experiments at present go, this is, however, a mistake. It certainly does not contain a terpene of the same formula as the turpentine terpenes. The sample which I have examined had the well-known repulsive odour of the plant and a yellowish green colour. Its specific gravity was ·9159. A column of the liquid, 100 mm. long, gave a rotation of + 55°. Hanbury found 50 mm. rotate to the extent of + 27°, an observation which is, practically speaking, the same as mine. By repeated fractional distillation a small quantity, not more than about 5 per cent. of the whole, was obtained, which boiled at 159°–160°. This had a dextro-rotatory power, 100 mm. deviating the polarized ray = 46° 18′. This fraction, however, is not a hydrocarbon at all.

The first indication that it was not a terpene was the impossibility of obtaining from it a crystallized nitroso-compound by the usual process. When analysed by combustion with oxide of copper, supplemented by a stream of oxygen, ·3975 gram gave 1·1415 gram of C O and ·388 gram of H_2O. These results calculated into percentages of carbon and hydrogen give the following numbers, from which it will be seen that the liquid contains oxygen, and is isomeric with ordinary camphor :—

	Exp.	Calculated for $C_{10}H_{16}O$.
C_{10} . . .	78·56	78·94
H_{16} . . .	10·84	10·53
O . . .	—	10·53

This liquid possesses an odour which is much less disagreeable than that of the original oil, though to a certain extent reminding of it.

The greater part of the savin oil consists of liquids which boil at temperatures above 200°. They are probably hydrocarbons that are very easily polymerised by heat, for a portion that has once been distilled over cannot be redistilled without leaving a very considerable residue of yellow colour and high boiling point, and which on cooling becomes so viscid as to be semi-solid. The examination of these higher fractions is not yet completed. It may, however, be said that savin oil is certainly not a true turpentine, for it does not contain a terpene.

Lavender.—English oil of lavender when submitted to distillation, began to boil at 135° to 140°, but the ebullition was probably chiefly due to the escape of a little vapour of water, which came over first. The temperature rapidly mounted to 190°, and between 190° and 195° about one-third of the oil passed over. The residue in the flask was rather darker in colour than the original oil. A portion of the first distillate dried by calcium chloride gave no crystalline nitroso-compound by the action of nitrosyl chloride, neither did it answer to this reaction after it had been carefully fractioned and treated with sodium. A small quantity of liquid thus prepared boiled at 171°–172°. Lavender oil seems to be a mixture of liquid camphors. Mr. Shenstone has undertaken its further examination, and I therefore leave the matter in his hands.

Oil of Caraway.—Two and quarter pounds of English oil of caraway submitted to distillation gave about seven fluid ounces of a terpene boiling below 178°, and of which 100 mm. rotate the polarized ray 11° to the right. The residue contained a further quantity of the hydrocarbon, but it consists chiefly of carvol ($C_{10}H_{14}O$ – B.P. 225°), a compound which is also dextrogyrate in its action upon polarized light. 25 mm. give +15·6°. It is characterized by forming a peculiar crystallizable compound with sulphuretted hydrogen $(C_{10}H_{14}O)_2SH_2$.

Carvol is converted into an optically inactive isomeride, carvacrol, by treatment with phosphoric acid.

As to the terpene contained in caraway oil, it gave me a nitroso-compound, which is identical in melting point, solubility, and crystalline form with that obtained from the terpenes of the sweet orange and other plants of the orange tribe.

Oil of Sweet Orange Peel (Essence de Portugal).—This oil, like most other essential oils, varies in composition. This is especially true of those which, like lemon, orange, and bergamot, are obtained by expression or by the sponge process.

Thus, with reference to oil of sweet orange peel, Wright (*Year-Book of Pharmacy*, 1871) states that he obtained from this oil no less than 97·2 per cent. of hydrocarbon boiling below 179° and 2·8 per cent. of yellow resinous substance, not volatile without decomposition. The material used in my experiments was the contents of an original tin of Ess. Portugal, obtained from Messrs. Piesse & Lubin, and when submitted to distillation it yielded about three-fifths of its bulk at 174°–175°. The residue boils at a much higher temperature. It is greenish yellow, very fragrant, smelling much more strongly of the fruit than the distilled portion. After standing some weeks it began to deposit a colourless crystalline substance, and this after some months has increased considerably in quantity. A similar deposit is obtained both from bergamot and lemon oils, and all three probably consist of the substance which has been called "bergaptene," and which is perhaps identical with hesperidene. This is a question which I propose to investigate as soon as time will permit. The terpene of the orange oil is a liquid which has an odour by no means so powerful as that of the original oil. It boils at 174°–175°, and 100 mm. rotate a polarized ray 85·9° to the right. It yields by appropriate treatment a nitroso-compound which melts at 171° and crystallizes very beautifully in large flat prisms. The alcoholic solution of this compound is lævorotatory.

Oil of Bergamot.—The best commercial oil of bergamot was submitted to distillation. About three-fifths, containing a little water and acetic acid, came over below 190°. This gave about one-fourth of its bulk below 180°, and this, after treatment with sodium for some hours, came over almost entirely below 176°, so that the oil readily yielded 15 per cent. of its bulk of terpene. Probably more might have been obtained. 100 mm. of this hydrocarbon rotate the polarized ray 75·6° to the right. This hydrocarbon gives the same nitroso-compound as hesperidene, the turpene from sweet orange. They are, therefore, chemically identical. They are also very near together in regard to physical properties. With boiling point 174°–175°, and optical characters not greatly different, I think it probable that if completely purified they would be found to consist of the same substance.

The higher boiling portions of the bergamot oil are green, and consist of oxidised compounds which have not yet been properly examined. After standing some time a considerable quantity of colourless crystalline matter (bergaptene) is deposited.

Oil of Lemon.—I have reserved to the last the description of lemon oil, because the investigation of the hydrocarbons it contains has been somewhat troublesome. It yields by distillation a large quantity of a colourless liquid boiling between 173° and 176°, and 100 mm. of which were found to rotate the polarized ray 61·5° to the right. When treated with nitrosyl chloride it yields only a very small quantity of a nitroso-chloride, which, however, contains 17·13 per cent. of chlorine, and therefore has the general formula $C_{10}H_{16}NOCl$. This precipitate was, however, found to be a mixture of two substances, for when heated as described at the beginning of the paper, it gives two nitroso-substitution compounds: one recognisable by its crystalline form as nitroso-terebenthene, the other *probably* identical with nitroso-hesperidene.

Further, when some of the hydrocarbon was mixed with nitric acid and alcohol according to the process of Wiggers, it gave, on standing, crystals of a turpin hydrate in quantity very much smaller than was obtained from a similar quantity of turpentine oil. But though the quantity of crystals was very much smaller than is given by either right or left-handed turpentine oil, their form is identical with that of ordinary terpin hydrate, and quite undistinguishable from it. This was shown by actual measurement of the crystals, which, after recrystallization from spirit, are large and rather well formed.

Again, Dr. Gladstone, who examined in 1864 a perfectly genuine lemon oil gave +67·7° as the rotation of 100 mm. of the hydrocarbon. I only found +61·5°.

These considerations lead to the conclusion that the sample I had to examine contained a quantity of a hydrocarbon which is lævogyre and yields the same chemical derivatives as terebenthene. Since oil of lemon is so well known to be commonly adulterated, I think it by no means improbable that French turpentine, which is lævogyrate, may really have been added to this sample. The admixture of 8 or 10 per cent. of ordinary French turpentine oil would be sufficient to reduce the rotatory power to the extent mentioned. But notwithstanding the undoubted existence of this hydrocarbon in the sample examined, it is by no means proved that its presence is adventitious. It may be a normal constituent of the oil. Further inquiries only can settle this question.

But there are other facts to be accounted for. Some of the liquid distilled from the oil of lemon was oxidised by boiling with acidified bichromate solution. It gave a considerable quantity of paratoluic and terephthalic acids. This could not have been entirely due to the presence of a turpentine oil, for the turpentines give by oxidation mere traces of these acids. Moreover, when the terpin hydrate crystals, referred to above as having been obtained from the oil, were oxidised in the same manner, they gave a very minute quantity of the same acids. The distilled lemon oil, therefore, contains something else, which, by oxidation, yields terephthalic acid. The hydrocarbons of the orange group do not furnish this compound. can, therefore, only suppose that this other constituent is cymene, $C_{10}H_{14}$, which boils at 176°, that is at nearly the same temperature as the lemon hydrocarbon. Its presence would not be discernible by the odour, which resembles to some extent that of lemon, and would account for the difficulty experienced in preparing the nitroso-chloride of the terpene. I have made some attemt to isolate the cymene which I suppose may be present, in the following way:—The distilled oil (173°–176°) was boiled for about ten days in a flask with an upright condenser, in the hope of polymerizing the terpenes. The liquid then distilled off between the same limits of temperature left a considerable quantity of liquid of higher boiling point, slightly yellow colour and strong lemon odour. The distillate, however, was not much changed in optical rotatory power. It was then sealed in tubes and heated to about 240° for about twelve hours. On distilling off again at about 176°, a further residue of high boiling polymerized hydrocarbon was left, but the distillate still rotates + 55° 9′ for 100 mm.

There are probably several varieties of cymene, of which one is, believe, dextrogyrate, but at the most to the extent of 12° or 13° for 100 mm.*

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* Guareschi, *Gazetta Chimica Italiana*, iii., 545–550.

A specimen prepared by myself from turpentine by the action of sulphuric acid was found to be quite inactive, and another separated from oil of cumin, and kindly lent to me by Dr. C. R. A. Wright, is also destitute of rotatory power. I am, therefore, still in doubt as to whether cymene is a natural constituent of oil of lemon or not.

General Observations.

Of the various constituents of volatile oils, the terpenes ($C_{10} H_{16}$) which are present in so many of them, contribute less than any other to the peculiar odour of the oil. The natural terpenes are colourless, limpid liquids, which vary in specific gravity from about ·84 to about ·86. They are divisible into two groups as follows:—

1. *Turpentine Group.*

Boiling point, 156° to 160°.
Melting point of nitroso-derivatives, 129°.
Form solid crystalline hydrated terpin, $C_{10} H_{20} O_2 . H_2 O$.

2. *Orange Group.*

Boiling point, 174° to 176°.
Melting point of nitroso-derivative, 71°.
Form (by Wiggers' process) no solid crystalline terpin hydrate.

The liquids included in each group are allotropic modifications of the same hydrocarbon distinguished one from another by their various rotatory action on the polarized ray. It will, however, be found, I believe, that the terpenes from several different plants will on further examination be conclusively proved to be really identical and not simply isomeric. This I believe to be the case with the terpenes from French terpentine and sage, also with the terpenes from orange peel, bergamot, and lemon. The differences of odour which they usually exhibit are undoubtedly due to the presence of small quantities of the heavier constituents of the oil, which it is almost impossible to separate completely by simple distillation.

P.S.—I am aware that it is sometimes stated that oil of lemon in course of time is transformed into turpentine, and I suppose there can be no doubt that old samples gradually acquire a terebinthinate flavour and odour. I should be glad if members of the Conference would communicate details regarding any instance of this supposed conversion that may have come under their own personal observation. I should also be grateful for specimens, if they can be accompanied by a reliable statement of the history of each sample.

Mr. KINGZETT said he was glad to find that Dr. Tilden's examination of various essential oils had yielded results comparable with, and confirmative of, his own investigations referred to by Dr. Tilden. Both methods served to classify the numerous hydrocarbons, generally termed terpenes, into groups of distiuctive constitution. He might remark, *en passant*, that in an early paper, he (Mr. Kingzett) had demonstrated the existence of a terpene of the formula $C_{10}H_{16}$ in the oils of caraway, bergamot, lemon, etc. From his researches, as also those of Dr. Wright, it followed that all terpenes represented by the formula $C_{10}H_{16}$ yielded cymene, $C_{10}H_{14}$, by suitable treatment, and it further appeared that cymene from all sources was identical; he failed to perceive the grounds upon which Dr. Tilden believed in the existence of more than one cymene.

Dr. WRIGHT asked if there was any distinct evidence offered by Dr. Tilden as to the dissimilarity of the various cymenes obtained. Some few weeks ago, Dr. Tilden applied to him for samples of cymene for the purpose of ascertaining whether they possessed dissimilar rotating power on polarized light, but he had not heard whether he had found any difference in that respect. As regards other physical properties, specific gravity, refractive power, etc., the cymenes from eighteen or twenty essential oils were prepared by himself and his coadjutors; but no difference whatever could be discovered in any particular. As far as he remembered, the rotatory power had not been examined by Dr. Gladstone, and he should like to know if any other addition to their knowledge on that particular had been made.

Professor ATTFIELD, in reply, said Dr. Tilden did not seem to have examined the cymenes alluded to by Dr. Wright. [On the previous page it will be seen, however, that one cymene, that from oil of cumin, was examined.—J. A.]

Mr. UMNEY thought no fixed rule could be laid down as to the rotating power of the essential oil of caraway of trade; for instance, sometimes the whole plant was put into the still, sometimes distillers used Dutch caraways, and sometimes Mogador caraways, and it could not be supposed that the rotating power of the oils derived from such different materials could be identically the same.

Mr. SCHACHT said that he thought the physical properties, of which Dr. Tilden had taken cognizance, referred to the hydrocarbons distilled from the oils, not to those of the essential oils themselves. In some of these he believed there were great differences in the rotating power, some turning one way and some the other.

Professor ATTFIELD said that the rotatory power of the oils themselves was not alluded to in this particular paper, but Mr. Schacht was quite right in supposing that Dr. Tilden in his research had only experimented on the hydrocarbons obtained from the fractional distillation of the oils.

Mr. GROVES observed that it would be very useful if Dr. Tilden or any one else who studied this matter could tell them how to prevent that disagreeable change of flavour which took place in oil of lemons left for a time in contact with the air.

Dr. WRIGHT said there was a practical way of preventing this change in flavour in some essential oils, which was adopted by perfumers, and consisted in keeping the oil in a tightly stoppered bottle, and filling the bottle up with water whenever the stopper was taken out. When prevented in this way from access to the atmospheric air, the oil retained its flavour much longer than in a half-empty bottle.

Mr. SCHACHT said it was rather curious that while Dr. Tilden considered the odorous principles of these oils to be due to the oxygenated body associated with the hydrocarbons, this beautiful smell of the freshly prepared essence should be spoiled by further oxidation.

Mr. ATKINS said he was struck some time ago with the tendency in certain essential oils to show a terebinthine result, but he found by comparative experiments that if the stock were kept in a cellar, away from light and heat, this process of decomposition was almost entirely prevented. It was probable also that the action of gas in the shop had a deleterious effect on these bodies.

A vote of thanks was passed to Dr. Tilden for his paper.

The next paper read was—

ON ESSENTIAL OIL OF SAGE. PART II.

BY M. M. PATTISON MUIR, F.R.S., EDIN.,
Assistant Lecturer on Chemistry; and

S. SUGIURA,
Chemical Student in The Owens College, Manchester.

1. In a paper communicated to the Conference at the Glasgow meeting, one of us gave an account of preliminary experiments upon the oil obtained by distilling sage with water. We have continued these experiments, and beg now to lay the results before the Conference.

2. The oil was separated into four main constituents; one of

these boiled between 156° and 158°, and another between 166° and 168°. Reasons were given for believing that each of these liquids consisted of a terpene of the formula $C_{10}H_{16}$. A third portion boiled from 198° to 203°, and was regarded as the oxidised liquid constituent of the oil. The higher fractions deposited solid matter when cooled; this solid matter possessed some of the properties of ordinary camphor.*

3. The liquid boiling from 156° to 158° has not been subjected to analysis, but the results of a determination of its vapour density, and a consideration of its general properties, leave no doubt that it really consists of a terpene, $C_{10}H_{16}$.

The vapour density was determined by a slight modification of Hofmann's method, which we have described in a paper communicated to the Chemical Society.† The method is easily and quickly carried out, and yields results sufficiently accurate for general purposes.

The following numbers were obtained:—

Height of barometer = 755 mm.

Temperature of air = 17°.

Height of mercury column in barometer tube = 561 mm.

Temperature of vapour = 185°.

Tension of mercury vapour at 185° = 12 mm.

Weight of mercury required to occupy space formerly occupied by vapour = 1018·4 grams.

Temperature of mercury = 20°.

Hence, volume of vapour = 73·28 c.c.

Weight of liquid = 0·0682 gram.

Weight of volume of hydrogen equal to volume of vapour under same conditions of temperature and pressure = 0·00101 gram.

Hence $\frac{M}{2} = \frac{\cdot 0682}{\cdot 00101} = 67\cdot 46$. Calculated = 68.

4. Dr. Tilden has kindly examined the action of nitrosyl chloride upon this terpene. The action is in every respect similar to that observed between nitrosyl chloride and the terpene from French turpentine oil.‡ The nitroso-derivative, $C_{10}H_{15}NO$, forms monoclinic prisms of the same form as those described by Story-Maskelyne in an appendix to the paper of Tilden referred to. "The plane ends are replaced by a sort of pyramid, which makes them look more

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* *Year-Book of Pharmacy*, 1876, 564.

† *Chem. Soc. Journ.*, vol. ii., 1877, p. 140.

‡ See Tilden, *Chem. Soc. Journ.* [2], xiii., 514.

pointed. In general appearance the crystals are not unlike dog-tooth spar." *

The melting point of the nitroso-derivative is 129°. The alcoholic solution of this substance is optically inactive.

A column of the terpene 100 mm. in length gave a rotation of 32·2° to the left for the soda flame.†

5. Dr. Gladstone has been so very good as to make determinations of the refractive indices of this and of the higher boiling terpene. His results for the terpene boiling at 157° are as follows:—

$\mu A = 1{\cdot}4611$. $\mu D = 1{\cdot}4667$ $\mu H = 1{\cdot}4855$ at 24·5° C.
Hence specific refractive energy = 0·0534, and
Refraction equivalent = 72·6

6. These determinations of optical properties agree very closely with those which have been made for the terpene from French turpentine oil (terebenthene). Moreover, the specific gravity of the sage terpene is practically identical with that of terebenthene. Riban ‡ gives the formula 0·8767—0·0008377t, as expressing the specific gravity of terebenthene at any temperature, t, below 80°. At 15° the specific gravity would be 0·8643. The specific gravity of the sage oil terpene is 0·8635 at 15°. The boiling points of the two terpenes are also almost identical—probably really identical. The small quantity of cymene which is almost certainly contained in this terpene (see par. 11) would tend slightly to decrease the specific gravity and slightly to increase the boiling point of the liquid.

In the following table we have noted some of the physical properties of terebenthene and of the terpene from sage oil boiling at 157°:—

B. P.	Sage Terpene. 157°.	Terebenthene. 156·25°
Specific gravity at 15°.	0·8635	0·8643 §
Refractive indices at 24°—		
for A.	1·4611	1·4596
,, D.	1·4667	1·4653
,, H.	1·4855	1·4845
Refractive energy	0·0534	0·0532
Refraction equivalent	72·6	72·5 ‖
Specific rotatory power $[\alpha]$	−37·3	−32·4 ¶ (for transition tint.)

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* Extract from letter from Dr. Tilden.

† Tilden, *Chem. Soc. Journ.*, vol. i., 1877, p. 557.

‡ *Compt. Rend.*, lxxviii., 288. § Riban, *Compt. Rend.*, lxxviii., 288.

Gladstone, *Phil. Trans.* for 1863.

¶ Berthelot, *Ann. Chem. Pharm.*, lxxxviii., 343.

7. The vapour density of the liquid boiling at 166° to 168° was determined.

Height of barometer = 758 mm.

Temperature of air = 18°.

Height of mercury column in barometer tube = 511 mm.

Temperature of vapour = 185°.

Tension of mercury vapour at 175° = 12 mm.

Weight of mercury required to occupy space formerly occupied by vapour = 874·7 grams.

Temperature of mercury = 20°.

Hence, volume of vapour = 64·61 c.c.

Weight of liquid = 0·0804 gram.

Weight of volume of hydrogen equal to volume of vapour under same conditions of temperature and pressure = 0·001129 gram.

Hence $\frac{M}{2} = \frac{\cdot 0804}{\cdot 001129} = 71 \cdot 2$. Calculated = 68.

Two experiments, in addition to that the results of which are detailed, were carried out, but in each a small quantity of air found its way into the barometer tube; the results therefore were too low. In every case a small quantity of brown resinous matter remained in the little bottle unvolatilized; hence, it appears either that the terpene contained a small quantity of a substance boiling very considerably above 185°, or that the action of such an amount of heat as is represented by this temperature exerted a decomposing (polymerizing?) action upon the terpene. The presence of 4 per cent. of a terpene of the formula $C_{15}H_{24}$—supposing this to remain completely unvolatilized—would bring the observed vapour density to 68·3, which is almost identical with the calculated number.

8. We are again indebted to the kindness of Dr. Tilden for experiments upon the action of nitrosyl chloride upon this terpene. Dr. Tilden says, "I could get no solid products from this liquid. The action of the gas caused effervescence immediately, and this is always a bad sign. I suspect this to be a mixture containing a hydrocarbon of the $C_{15}H_{24}$ type. I have never got any solid compounds from these."

A column of the terpene 100 mm. in length was found by Dr. Tilden to rotate the plane of polarization 17·7° to the left.

9. Dr. Gladstone has kindly made determinations of the refractive indices of this terpene for the lines A, D, and H.

$\mu A = 1 \cdot 4588$. $\mu D = 1 \cdot 4646$. $\mu H = 1 \cdot 4830$.

Hence, specific refractive energy = 0·0522, and refraction equivalent = 71.

10. The specific gravity of this terpene was 0·8866 at 15°.*

A mixture of 96 per cent. of the terpene boiling at 157° with 4 per cent. of a terpene of the type $C_{15}H_{24}$—assuming the latter to have a specific gravity of 0·915, which is about the mean of the densities of terpenes of this formula as determined by Gladstone, and assuming that no condensation of volume occurred through mixing the two liquids—would have a specific gravity of about 0·865 at 15°. The assumption that the liquid boiling at 167° is really such a mixture is not therefore borne out by the actual specific gravity of the liquid. We are rather inclined to believe that sage oil contains two terpenes of the formula $C_{10}H_{16}$, differing in physical properties, and perhaps a small quantity of a terpene of a higher molecular weight.

11. It has been already shown by one of us that the lower terpene of sage oil, boiling at 157°, very probably contains cymene. The experiment described in Part I. of these investigations† was repeated, and with a result identical with that formerly obtained. The liquid, which gave all the qualitative reactions of cymene, was analysed. It boiled at 176°–178°.

0·1885 gram gave 0·6125 gram CO_2 and 0·181 gram H_2O.

	Calculated for $C_{10}H_{14}$.	Found.
Carbon . . .	89·55 . .	88·61
Hydrogen . . .	10·45 . .	10·72

A small quantity of this cymene was oxidised by chromic liquor; it yielded terephthalic and acetic acids.

The residue after polymerizing the terpene with sulphuric acid, and distilling in steam, was boiled for some days with chromic liquor, no solid oxidation product was obtained.

Wright ‡ has shown that the terpene from orange-peel oil, boiling at 178°, yields no cymene when treated with strong sulphuric acid and distilled in steam; nor does it yield a trace of terephthalic acid on oxidation. The same chemist § has also shown that oil of turpentine yields cymene by treatment with sulphuric acid, etc. According to some chemists, terephthalic acid is one of the products of the oxidation of oil of turpentine; according to others this acid is not produced by oxidising that oil. The fact that when cymene had been removed from the liquid portion of sage oil, boiling at 157°, the residue yielded no terephthalic acid on oxidation, but that the original liquid, before treatment with sulphuric acid, etc., did yield

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* *Year-Book of Pharmacy*, 1876, p. 566. † *Ibid.*, p. 565.

‡ *Chem. Soc. Journ.* [2], xi., 552. § *loc. cit.*

this acid,* seems to point to the cymene which was present as the source whence the terephthalic acid was derived.

The varying results obtained in the oxidation of oil of turpentine are probably due to the varying composition of the specimens employed. When free from cymene this oil appears to yield no trace of terephthalic acid on oxidation.†

12. The liquid boiling at 166°–168° was treated with strong sulphuric acid, etc., as described in a previous paper. Cymene was again obtained. The polymerized residue yielded no solid oxidation product on treatment with chromic liquor.

13. Each terpene was treated with bromine in the manner previously described. A small quantity of a liquid, boiling from 174° to 177°, and yielding terephthalic acid on oxidation, was, in each instance, obtained.

14. The physical as also the chemical properties of the terpene boiling at 157° leave little doubt of the identity of this compound with terebenthene, the terpene obtained from French oil of turpentine. The terpene boiling at 167°–168° we believe to contain small quantities of a body of higher boiling point. We have already given reasons for this belief.

In a letter to one of us, Dr. Gladstone says, "The lighter terpene is practically identical with that from turpentine in refraction and dispersion, as well as in boiling point and specific gravity. The heavier one with the higher boiling point has a lower refractive energy than any terpene I have examined. Is it pure $C_{10}H_{16}$?"

Investigations carried out on larger quantities of oil can alone enable us to make positive statements regarding the composition of the higher terpene.

15. When that portion of the original oil which boiled above 190° was submitted to fractionation, a considerable proportion of it was found to boil between 198° and 203°.‡ For this liquid the name of salviol was proposed. We have analysed this liquid, and have also made a determination of its vapour density.

(1) 0·1664 gram gave 0·48 gram CO_2 and 0·162 gram H_2O.
(2) 0·130 ,, ,, 0·374 ,, CO_2 ,, 0·124 ,, H_2O.

	Calculated for $C_{10}H_{16}O$.		Found. (1)	(2)	Mean.
Carbon	78·94	. .	78·69	78·46	78·57
Hydrogen	10·53	. .	10·81	10·59	10·70
Oxygen	10·53	(by diff.)	10·50	10·95	10·73

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[*] *Year-Book of Pharmacy*, 1876, p. 565.

[†] W. Carleton Williams, *Ber. deut. Chem.-Ges.*, v., 1024.

[‡] *Year-Book of Pharmacy*, 1876, p. 563.

Vapour Density Determination.

Height of barometer = 755 mm.

Temperature of air = 17°.

Height of mercury column in barometer tube = 492 mm.

Temperature of vapour = 185°

Tension of mercury vapour at 185° = 12 mm.

Weight of mercury required to occupy space formerly occupied by vapour = 788·1 grams.

Temperature of mercury = 17°.

Hence, volume of vapour = 58·16 c.c.

Weight of liquid – 0·0786 gram.

Weight of volume of hydrogen equal to volume vapour under same conditions of temperature and pressure = 0·00107 gram.

Hence $\frac{M}{2} = \frac{\cdot 0786}{\cdot 00107} = 73{\cdot}49$. Calculated = 76.

A small quantity of resinous matter remained in the little bottle at the conclusion of the experiment. The weight of this non-volatile residue was found to be 0·0014 gram. The number given above as representing the weight of liquid taken is the difference between the actual amount weighed out and the weight of the non-volatile residue.

It would appear that the salviol examined was not perfectly pure, or that this substance is decomposed in some way at the temperature to which it was raised, with production of resinous matter. There can, however, be little doubt that the formula $C_{10}H_{16}O$ really represents, not only the quantitative composition, but also the molecular weight of salviol.

From the smallness of the quantity of salviol at our disposal we have not been able to carry out further experiments upon this substance.

16. The solid which separated from the higher boiling portions of sage oil has been examined by us. After several sublimations it melted at 184° to 186°. In Part I. the number 187° was given—this number we believe to be rather too high. The boiling point of sage camphor is 210°. We have attempted to determine the specific gravity of sage camphor; but as the result cannot as yet be looked upon as trustworthy, we do not give it, contenting ourselves with stating that the specific gravity appears to be greater than that of common camphor, and less than that of borneol. Sage camphor crystallizes in monoclinic prisms, ∞ P. m. P: the crystals are generally rounded off on the prism edges. An alcoholic solution of sage camphor is without action upon the polarized ray.

(1) 0·112 gram gave 0·324 gram CO_2 and 0·104 gram H_2O.
(2) 0·129 „ „ 0·375 „ CO_2 „ 0·124 „ H_2O.

	Calculated for $C_{10}H_{16}O$	Found. (1)	(2)	Mean.
Carbon	78·94 . .	78·83	78·86	78·84
Hydrogen	10·53 . .	10·31	10·67	10·49
Oxygen	10·53 (by diff.)	10·86	10·47	10·67

We have not made a vapour density determination, inasmuch as the results of analysis leave little doubt as to the correctness of the formula $C_{10}H_{16}O$, and the boiling point prevents the supposition that the molecular weight is represented by a multiple of this formula.

17. A quantity of sage camphor was dissolved in chloroform, and an equal quantity of bromine was gradually added, the vessel being kept well cooled. Reddish coloured crystals were almost immediately deposited. The whole was allowed to stand over sulphuric acid in vacuo, for twelve hours. When the vessel was brought into the ordinary atmosphere the crystals very quickly melted, and hydrobromic acid was evolved in considerable quantities. On standing for several days over sulphuric acid in vacuo crystals were again formed.

On distilling the red liquid very large quantities of hydrobromic acid were evolved, a camphor-like solid was deposited, and a considerable portion of the liquid was resinized. The solid camphor-like substance, after several sublimations, melted at 160° to 163°. A similar substance having the same melting point was prepared by treating sage camphor directly with bromine, washing with caustic soda, and subliming. In Part I. the melting point of the crystals obtained by treating a solution of sage camphor in chloroform with bromine is stated to be 132° to 133°. We believe that these crystals were most probably impure, containing either uncombined bromine, or, it may be, portions of an addition product of bromine and camphor. We find that the melting point of the crystals, produced as described above, increases after each sublimation until the maximum 160° to 163° is attained. During the earlier sublimations hydrobromic acid is evolved.

18. When sage camphor was distilled in contact with phosphorus pentasulphide, the greater part of the material underwent resination, but a small quantity of liquid was obtained which, after washing with soda, drying, and fractionating, gave the reactions of cymene: on oxidation with chromic liquor terephthalic acid was produced.

19. A few grams of sage camphor were dissolved in about ten parts of concentrated nitric acid, the liquid was boiled for thirty hours or so, the acid was distilled off, the residual semi-resinous matter was dissolved in hot water, and the solution was boiled down and set aside. A small quantity of a colourless indistinctly crystalline body was obtained. This substance melted at 172° to 176°. The quantity at our disposal was too small and not sufficiently pure to allow of an accurate analysis being made. The numbers which we did obtain agreed as closely as could be expected with those required by the formula for camphoric acid, $C_{10} H_{16} O_4$.

20. Sage camphor is almost certainly an isomer of common camphor: its melting point, boiling point, and other physical properties, as also the difference of its behaviour towards bromine, prevent us, however, from believing that it is identical with common camphor.

21. In the first part of these investigations the action of hydrochloric acid gas upon sage oil was said to result in the formation of one, or perhaps two, chlorhydrates stable at 200° or so. On making a determination of the amount of chlorine in the liquid boiling from 195° to 200°, 1·85 per cent. only was found to be present. Determinations of carbon and hydrogen gave no constant results, thus we obtained 70·53, 67·34, and 73·2 per cent. of carbon, and from 9 to 10·5 per cent. of hydrogen. These results show that the liquid under examination was not really a chlorhydrate at all, but was evidently a mixed substance. If a chlorhydrate be in the first instance produced by the action of hydrochloric acid upon sage oil, it is evidently very readily decomposed by washing with water. The statement in par. 7 of Part I.,* that the chlorhydrate of sage terpene is with great difficulty decomposed by water is therefore erroneous.

22. When sage oil is distilled a very large quantity of resinous and semi-resinous matter is produced. That portion which remained after the thermometer had risen to 240° in the first distillation of the oil was a thick, viscid, very dark coloured liquid. In the hope of procuring a further quantity of salviol, we subjected this liquid to distillation in a current of superheated steam. About one-eighth of the total liquid was obtained in the distillate, the remainder having become almost solid. The distillate after drying and fractionation was found to consist almost completely of camphor, held in solution by terpene. No salviol was obtained. We did not consider that an analysis of the residual resin would yield any trustworthy results.

23. Our investigations are not sufficiently complete to allow us

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* *Year-Book of Pharmacy*, 1876, p. 562.

to enter into theoretical discussions concerning the structural formulæ of camphor and the substances related to it, nor can we venture to make any generalization concerning the members of the terpene group. Both of these subjects are, however, of so much interest that we propose, if the Conference will make us a further grant, to endeavour to prepare much larger quantities of the terpenes, the salviol, and the camphor from sage oil, and to determine the physical and chemical properties of these bodies, combining this investigation with a research into the constitution of the camphors in general.

We take this opportunity of again returning our best thanks to Drs. Gladstone and Tilden for their kindness in examining the optical and other properties of the two sage terpenes.

Professor ATTFIELD said this paper was very interesting. Of course it was rather chemical than pharmaceutical, and seeing that the Chemical and Royal Societies had now followed the plan, which the British Association had initiated and the Conference practised, of making grants in aid of such researches, he thought the Conference might now discontinue, at any rate for the present, further grants for such purely chemical investigations as this bid fair to become. He thought that no one would charge him with discouraging research after any kind of truth. The point was whether or not it was expedient for that *Conference* to contribute money in support of *abstract* chemical science. The sum annually at the disposal of the Conference was not large, still it was formed by the contributions of pharmacists, hence workers at pharmaceutical research, or at scientific research which at least gave promise of pharmaceutical application, had first claim upon it. He feared, however, that such claimants would be only too few.

The PRESIDENT remarked that this was hardly a paper which would admit of much discussion, but he was sure they would agree in thanking the authors for it.

The next paper read was a report on the Proximate Constituents of the Ivy, by R. H. Davies.

THE CONSTITUENTS OF THE IVY—"HEDERIC ACID."

By Robert H. Davies, F.C.S.

At last year's Conference in Glasgow, I had the honour, in conjunction with Mr. C. H. Hutchinson, of reading a paper in which some of the leading characters of so-called hederic acid were mentioned. Some little additional work having been done upon this substance during the past year, I proceed to report upon it. As already stated, so-called hederic acid consists solely of carbon, hydrogen, and oxygen. Three analyses have already been published of this body—two in 1849 by Professor Posselt, to whom we owe its discovery, and one in April, 1875, in Dr. Hartsen's paper on "A New Substance in Ivy Leaves," This new substance I last year showed to be identical with Posselt's hederic acid.

I have found it exceedingly difficult to burn "hederic acid" completely by the ordinary combustion process. When oxide of copper is employed I have never succeeded in converting the whole of the carbon into CO_2. With chromate of lead better results have been obtained; but the method finally adopted was to mix the substance with a mixture of chromate of lead and bichromate of potassium in a tube, the fore part of which for 6 or 7 inches was filled with dry copper oxide. By this means I have obtained results which compare favourably with those obtained by burning the weighed subtance mixed with granular oxide of copper in a stream of oxygen. The substance lost, Exp. *a*, 4·87 per cent., Exp. *b*, 4·77 per cent. of water at 100° C.; mean of the two, 4·82 per cent.

Exp. 1. 0·1729 gram of the dry substance taken yielded 0·4304 gram CO_2 and 0·1452 gram H_2O.

Exp. 2. 0·1546 gram yielded 0·3818 gram CO_2 and 0·1287 gram H_2O.

Exp. 3. 0·309 gram yielded 0·7712 gram CO_2 and 0·2548 gram H_2O.

In these three experiments the substance was burned, mixed with granular copper oxide in oxygen.

Exp. 4. 0·1532 gram "hederic acid" yielded 0·3787 gram CO_2, and 0·1268 gram H_2O.

Exp. 5. 0·1628 gram yielded 0·4037 gram CO_2 and 0·1382 gram H_2O.

In these two experiments the mixture of chromates was resorted to for the combustion.

The formula $C_{16}H_{26}O_4$ would require 68·08 per cent. carbon and 9·22 per cent. hydrogen.

The foregoing experiments indicate the following percentages:—

	I.	II.	III.	IV.	V.	Average.	Theory for $C_{16}H_{26}O_4$.
Carbon	67·88	67·37	68·03	67·41	67·63	67·66	68·08
Hydrogen . . .	9·33	9·24	9·16	9·19	9·43	9·27	9·22
Oxygen (by difference). . . .	22·79	23·39	22·81	23·40	22·94	23·07	22 70
	100·00	100·00	100·00	100·00	100·00	100·00	100·00

The percentage of carbon is greater in every case than was obtained by either of the experimenters before alluded to,* an error on their part which I think due to the difficulty of completely burning the substance. Neither of them attempted to deduce a formula from the percentages he obtained.

Attempts to produce salts of barium, calcium, potassium, sodium, aluminum, copper, and silver, have been attended with uniformly negative results; and I have no reason to doubt that my former statement that this substance is not an acid is correct. An ammonium compound has been produced, but the amount of ammonia contained is so small as to preclude the probability of its being an ordinary salt. It is now under investigation.

A lead compound of "hederic acid" may be formed by mixing alcoholic solutions of "hederic acid" and lead acetate, but the difficulty of purifying it has hitherto prevented my making an analysis. It is noteworthy that the mother-liquor in this case is *not* acid, as would be the case if the ordinary double decomposition took place, hederate of lead and acetic acid being formed.

With substitution products I have been more successful. It was stated last year that a probable nitro substitution product had been formed; this has since been prepared and analysed.

It is easily soluble in chloroform, in which "hederic acid" is insoluble, so that it may be purified by making use of this fact. 0·5586 gram of the nitro product dried in air over sulphuric acid yielded 0·0225 gram H_2O at 100° = 4 03 per cent.

Exp. 1. 0·0950 gram of the dry substance yielded 0·2045 gram CO_2 and 0·0691 gram H_2O.

Exp. 2. 0·1916 gram of the dry substance yielded 0·4098 gram CO_2 and 0·1221 gram H_2O.

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* In Hartsen's paper the numbers are C 63·44 per cent., H 10·4 per cent. Posselt gave 66·49 and 66·43 per cent. carbon, 9·5 and 9·41 per cent. hydrogen.

Exp. 3. 0·2995 gram of the dry substance examined for nitrogen by Dumas' method.

Temperature 21·5° C. Height of barometer, 745 mm. Difference in level of mercury, 140 mm. Tension of water vapour, 19·7 mm.

Volume of nitrogen 15·6 c.c. reduced to temperature 0° C. and B. P. 760 mm. = 11·13 c.c. Weight of nitrogen = ·01396.

These numbers in percentages are as follows :—

The formula $C_{16} H_{25} (N O_2) O_4$ requires—

C 58·71, H 7·64, N 4·28 per cent.

	I.	II.	III.	Average.	$C_{16} H_{25} (N O_2) O$ requires
Carbon	58·69	58·33	—	58·51	58·71
Hydrogen . . .	8·08	7·08	—	7·58	7 64
Nitrogen	—	—	4·66	4·66	4·28
Oxygen (by difference). . . .	—	—	—	29·25	29 37
				100·00	100·00

There can, I think, be little doubt that the formula $C_{16} H_{25} (N O_2) O_4$ expresses the composition of this substance, and thus the formula $C_{16} H_{26} O_4$ assigned to the original substance is confirmed.

It seems probable that I shall have another nitro product to report upon, as a substance differing in some particulars from this one is yielded by acting upon "hederic acid" with nitrous anhydride, evolved from a mixture of nitric acid and arsenic; this may turn out to be a nitrosyl derivative.

A bromo derivative has also been obtained, but is not yet analysed.

The results of the destructive distillation of "hederic acid" promise to be interesting. When heated alone, the heat being carefully regulated, charring soon takes place, without any preliminary volatilization, and then the black liquid which is produced gives off dense vapours, which condense to produce what I think is a mixture of two or more fat-like substances, soluble in alcohol and ether, and having a peculiar tarry odour. A small quantity of permanent inflammable gas is also produced. The fatty substances do not react with ordinary reagents in any marked way, but with nitric acid a nitro substance is formed, and precipitated on dilution with water, so that I trust to effect some separation by this mode of operating.

I have retained the name "hederic acid" for convenience, but trust, after some further investigations, to find a name which will more correctly express the constitution of this substance.

I am greatly indebted to Messrs. C. H. Hutchinson and R. H. Parker for the help they have kindly afforded me; to Messrs. Corbyn for preparing the crude hederic acid; and to Professor Attfield for freely permitting the use of the laboratory of the Pharmaceutical Society in this research.

This was followed by a—

NOTE ON HEDERIC ACID FROM IVY LEAVES.

By Charles T. Kingzett, F.C.S.

At the 1876 meeting of the British Pharmaceutical Conference, Messrs. R. H. Davies and C. H. Hutchinson read a communication on the "Chemical Constituents of the Ivy." In that paper certain references were made to former researches upon this subject, but little new matter was brought forward, beyond a further description of the properties of so-called hederic acid, a name given to the substance by Posselt.*

Hederic acid, when pure, is a snow-white powder, insoluble in ether, but soluble in hot alcohol. That specimen which formed the subject of the present paper was kindly given to the author by Mr. R. H. Davies, and amounted to several grams only. When Mr. Davies read his paper, I then suggested that hederic acid was a body constructed on the type of a saccharide, inasmuch as I had found many bodies of this constitution to give, with strong sulphuric acid, a purple colour, like to that given, as Posselt found, by hederic acid; and because this substance gives, on boiling with dilute sulphuric acid, a solution which reduces Fehling's copper test.

Since the time mentioned, I have, in conjunction with my friend, Dr. H. W. Hake, published an account † of a number of new reactions in organic chemistry, similar to the one above described, due to hederic acid, and in the continued prosecution of this study I have subjected this last-named body to a closer examination.

When heated on platinum foil, hederic acid melts to a colourless oily-like substance, which emits a dense white aromatic and inflammable vapour, and on continuing the heat the whole of the substance boils away in this manner, leaving no ash and no charcoal.

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* *Ann. Chem. Pharm.*, lxix, 62. See also paper by Dr. F. A. Hartsen, in *Archiv der Pharmacie*, April, 1875.

† "On Some New Reactions in Organic Chemistry, and their Ultimate Bearings," *Pharm. Journ.*, May 12, 1876.

As already stated, it strikes with strong sulphuric acid a purple colour, which does not form immediately; but this colour is not nearly so intense or so beautiful as that which is immediately formed when a trace of sugar is present, or more faintly when a drop of water is added; further addition of water causes the destruction of this colour.

With the object of finding an explanation of this reaction some further experiments were made.

Posselt gave no formula to hederic acid, but in one analysis found it to contain 66·5 per cent. carbon, and 9·5 per cent. hydrogen. He also found that the substance lost 5·42 per cent. water at 100° C., and chars without melting at a higher temperature.

From Posselt's figures, the simplest formula that results is $C_4 H_6 O$; the true formula would be a multiple of this.

An attempt was made by the writer to isolate sugar from the molecule of hederic acid by boiling it for a long time (twenty hours) in contact with a two per cent. solution of sulphuric acid. No visible change occurred, but the solution contained a substance much resembling sugar in its properties. The sulphuric acid was removed by baryta water, and the excess of this by carbonic anhydride, and on evaporation of the filtrate to dryness it left a sticky transparent barley sugar-like mass, possessed of the following characters:—

It contained barium.

It gave with camphor and sulphuric acid the purple colour which Hake and I have shown sugar to produce.

Its aqueous solution reduced Fehling's test readily, and also nitrate of silver.

Strong sulphuric acid charred it in a manner resembling the action of the acid upon sugar.

After drying at 100° it admitted of pulverization.

On analysis it afforded the following results:—

(1) 0·290 gram gave on combustion with plumbic chromate 0·110 gram $H_2 O$; an accident ruined the carbon estimation.

(2) 0·190 gram gave 0·103 gram $Ba S O_4$. These figures give 4·42 per cent. H and 31·84 per cent. Ba, the two elements standing in the relation of 1 Ba to 19 H. This is identical with the relationship exhibited between the same constituents of a similar substance obtained in a like manner from scammony-resin. Assuming gluconic acid, $C_{12} H_{18} O_9$, to be dibasic, its barium salt, $C_{12} H_{16} Ba O_9$, would contain 31·06 per cent. Ba and 3·62 per cent. H. On the other hand, glucosate of barium, $2 (C_6 H_{11} O_6) Ba$, contains 27·8 per cent. Ba and 4·44 per cent. H.

I have no doubt that the body derived from hederic acid, whose analysis is given above, represents an intermediate state occurring in the spontaneous change of glucosate into glucinate of barium. Of its sugar-like character, however, there can be no doubt.

Mr. DAVIES said Dr. Hartsen had stated that the substance he had discovered in ivy leaves yielded sugar when boiled with dilute sulphuric acid. He went so far indeed as to give the exact amount of sugar, 33·38 per cent. He (Mr. Davies) had shown the substance to be identical with hederic acid, and in consequence of a remark made by Mr. Kingzett at the Glasgow meeting had performed the same experiment, taking the same means to get rid of the sulphuric acid employed. Although he had not analysed the barium compound, he had shown the presence of sugar by the fermentation method. Mixed with a little yeast the syrupy liquid yielded carbonic acid, so that as the result of the investigation of three observers there could be no doubt that this body was a glucoside, though what the nature of the other substance was remained to be determined. He hoped to have the opportunity of showing this, perhaps at the next meeting.

Mr KINGZETT said, in justice to himself, he must remark that he had not seen Hartsen's paper at the time of the last meeting of the Conference, and had never previously heard of hederic acid, but had made the suggestion on hearing of the colour reaction quoted by Mr. Davies from Posselt. It was true Posselt made the solution and found it reduced Fehling's test; but that did not prove that it contained sugar, as there were other substances that effected a similar reaction.

Mr. DAVIES did not think he had mentioned Posselt, if so it was in mistake for Dr. Hartsen, who stated that he had found a new substance in ivy leaves. Dr. Hartsen appeared to be manufacturing chlorophyll when he found this new substance in ivy leaves—he described it in the *Archiv der Pharmacie* for April, 1875. On seeing this paper, Mr. Davies concluded that this substance was identical with Posselt's hederic acid, and experiments showed this to be so.

Mr. KINGZETT explained that for a long time he had been occupied with studies of bodies some of which give, with strong sulphuric acid alone, a violet colour, and others which give this reaction on the further addition of cane sugar. It was in virtue of special knowledge, therefore, he had suggested that hederic acid was a glucoside. He had put his own suggestion to experimental test, and had substantiated its truth, and Mr. Davies had in this respect imitated him and confirmed the result. As Mr. Davies seemed acquainted with Hartsen's paper, he could probably tell the meeting whether Hartsen had really effected any analyses of the sugar, or had contented himself with the reduction test.

Mr. Davies could not tell.

The President in proposing a vote of thanks to Mr. Davies and Mr. Kingzett, said he hoped this subject would lead to some further communications.

The next paper read was on—

THE SUPPLY OF CINCHONA BARK AS CONNECTED WITH THE PRESENT PRICE OF QUININE.

By John Eliot Howard, F.R.S.

The price of quinine is at the present moment abnormally high; and a medicament which, in many portions of the world, has become a prime requisite for healthy life, is thus placed almost out of reach of the masses of mankind.

The cause of this undesirable state of things is to be found, not in any natural failure of the supply of the material from which it is derived, but entirely from the cruel and desolating effects of war in those portions of South America which have till quite recently furnished the largest importations of cinchona bark. I have described, in my "Quinology of the East Indian Plantations," the gradual exhaustion of some of the Andean districts, such as the Bolivian forests, which were first depended upon; and the increasing importance of the Columbian districts, on which the war above alluded to has since told with fearful effect. It has, I understand, deranged the whole traffic. The interruption of the import trade during the war, and the failure of many houses, destroyed the means to pay for the bark. Many of the bark collectors have perished; and the small passes and paths to bring the bark from the forests have more or less been destroyed by the tropical vegetation, and must be opened again. It will take some time to remedy all this, and even yet the disturbances have not entirely ceased.

The dearth of supply of quinine-producing material thus produced has been to some extent alleviated by the importations of cultivated cinchona bark from the East Indies, both from the British and Dutch possessions. Without this help the dearth would have amounted to an absolute famine. It is very satisfactory to think that the naturalization of the cinchona in these regions should already have produced such good results; so that the value of the importations from the Government plantations of Ootacamund alone have realized, it is said, some £35,000. I have no means of computing the amount cleared by private owners of plantations, but there can be little doubt that the recompense for their venture has been of a satisfactory nature thus far; and perseverance in a right course will lead to permanent good results.

In order to this end, they must guard against being deceived by present prosperity. I am inclined to believe that plantations will be undertaken without sufficient foresight, and specially without taking sufficient pains to select really good quinine-producing sorts of cinchona. It is quite true that all the leading species seem to improve by cultivation. So that the bark of the *C. officinalis*, *C. Calisaya* (in its best forms), and also of *C. succirubra*, are much richer in alkaloid than when grown in their native forests; but I must reiterate the opinion that nothing but first-class cultivation and wise and discriminating management will in the end be successful.

The present price of quinine cannot be maintained, and will in all probability be followed, not *speedily* but *eventually*, by a reaction which will place it at a lower level than it has been for a considerable time. The causes that must produce this result are obvious. Not only are the plantations increasing in India,* but even in South America, in certain districts, wealthy landed proprietors are beginning to be aroused, intending to avail themselves of the great natural advantages they possess for cultivation. I have recently been consulted by some of these, who have been led to the consideration of the subject.

Of course any supply of cultivated bark from America might easily be interrupted; and present experience shows how important it is to have a source of supply independent of the political troubles which afflict the new world; but with moderate care and success, it must be presumed that cinchona bark might be cultivated in South America under conditions very favourable to cheap production, by those who can command a sufficient amount of capital and can secure labour of the requisite stamp.

I think that well-conducted cinchona plantations, whether in the Old or the New world, must always be profitable, but that the inferior will be eventually a failure, as unable to stand the competition when all is at a low price. I have thus far only looked at the

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* I have recently seen fine succirubra bark from Borneo.

production of quinine. I cannot foresee what will happen as to the other alkaloids, but it is reasonable to suppose that *surely*, though it may be *slowly*, they will take their proper place in medical practice; as regards cinchonidine, at any rate, the supply is so very abundant (the most so perhaps of all the alkaloids) that the price will always be *low* in proportion to quinine. This must be considered by those who grow plantations of *C. succirubra*, in which this alkaloid abounds. My own impression is that cinchonidine is in no sense inferior to quinine, but somewhat different in its operation, and in some cases (especially in children) to be preferred to the favourite medicine. A similar remark may be made in reference to quinidine, which is coming much into favour in some quarters, but can never be so cheap as cinchonidine, as it is a comparatively rare product. Cinchonine is, in my opinion, as powerful as quinine. At all events, I use no other alkaloid in gratuitous administration, and never fail to arrest with it the intermittent fevers, of which we meet with examples in this country. I do not know whether the quantity required to effect the result is relatively greater than with quinine.* Cheapness and facility of administration are my inducements to employ the "muriate of cinchonine," though I am inclined to think that the concomitant effects are rather more unpleasant than with quinine; and as regards the other and rougher alkaloidal products, I am satisfied that such is the case. I have some reason to suspect emetic effects as attending one of these. All these medical questions ought to be settled by competent authority.

I would encourage the cultivators to believe that they have nothing to fear from the possibility of the artificial production of quinine. The results of examination by polarized light lead to the inference that the molecule of quinine (for instance) is built up in such a manner that it cannot be imitated by processes which we can employ, although these may produce useful antifebrile substance. Such at all events is my opinion, and has been that of other labourers in this field. There is indeed very much more to be learned in reference to the influence of various agencies on the plants themselves, bearing on the interchange chiefly between quinine and cinchonidine and cinchonine and quinidine, according to the place of growth and the degree of exposure.

Otto Kuntze, a writer in the *Botanische Zeitung* of 13th and 20th April, 1877, gives us information both on these and other subjects

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* Following the best medical authorities, I have often cured agues which had been unsuccessfully treated by too small doses of quinine.

connected with quinology, which would be remarkable if correct; but being unsustained by any proofs other than the infallibility of the writer, will not, I suppose, be received, except by the worshippers of *Einsicht.*

He sets aside the labours of all previous botanical observers, adopting only my one species of *C. Pahudiana*, and includes all the rest (for if I understand him aright, he finds all the South American species in Java and India, under the new heads *C. Weddelliana*, *C. Pavoniana*, and *C. Howardiana*.

Now I must protest that I have not the slightest claim to have this species named after me, for this plain reason, that it was discovered and described, and well named *C. succirubra*, long before my acquaintance with the genus began. That which I was enabled to do was to resuscitate the somewhat buried and forgotten knowledge of this now widely spread and specially important species. In my examination of Pavon's collection of Peruvian barks, published in the *Pharmaceutical Journal* for 1852, I said, after describing the bark No. 45, the *Cinchona succirubra*, "red juice," whatever its botanical origin, is, I think, commercial "red bark." At a later period (1855–6) I was in possession of authentic specimens from South America, which I described in the same journal of October, 1856, with a plate of the leaves. I also stated that I had found in the preceding year Ruiz and Pavon's botanical specimen of this plant.

Later on, in 1858, I received from South America more abundant and more instructive specimens from Quito, which I have described in my illustrations of the Nueva Quinologia (1862) of Pavon, together with Pavon's diagnosis written in 1826. In 1866 I gave more particulars in reference to the varied forms under which this species appears, which will be found in the report of the Botanical Congress published in 1867. I have now from all quarters beautiful and typical specimens and flourishing plants of this *C. succirubra*, and of its hybrids, which assume indeed such a polymorphous shape that I think out of 800 young plants, which I reared at one time, a person ignorant of their hybridity would have had no difficulty in discovering more than the supposed seventy species to which our author refers.

It is quite otherwise with the unhybridized seed, and with the plant in its original habitat. It is a notably distinct series of forms, markedly distinguished by the chemical composition as well as by botanical characteristics. The word succirubra points to this, for although not generally understood, the juice is wholly different in its chemical reactions, and the tannin strikingly contrasted with that of other cinchona.

It is known from the observations of many observers, that spontaneous hybridizations take place almost always between types relatively markedly distinct, rather than between species offering much affinity.

It is perhaps from this cause that the *C. succirubra* tends so much to form hybrids in the Indian plantation. M. Alexis Jordan remarks that "one only species may fecundate many others, and throw disorder into a whole collection. For practical florists there is here sometimes a precious advantage, but for the botanist who seeks to assign limits to species it is a veritable plague; for hybridity introduces confusion, and *chaos reigns wherever it plays a part and gives fertile products.* That which is best to be done in this case is to destroy the hybrid subjects and to throw away their seeds. In order to recommence the study, it is necessary to have new seeds and new subjects."

It is difficult to get seed that may be depended upon from the mixed plantations in India. As an illustration of this, I will describe the results of a sowing of seed professedly of *C. officinalis*, *C. succirubra*, and *C. Calisaya*, obtained from Kew, and said to be from Java.

The young plants developing will give me seventeen of *officinalis*, of which one appears hybrid—the rest sorts but not the truest form—ten of *C. succirubra*, of which not one even approaches to the true form, and forty-six *Calisaya*, more or less hybridized, but a fair number promising pretty well, and amongst these forty-six, two or three of a curious *sport* with parti-coloured leaves. It is impossible to say what the value of such a sowing would be when grown up into a plantation.

On the other hand, it is an undeniable fact, that the best results have been obtained from plants of which the genealogy is known, and the succession kept perfectly pure. There is not in British India any *plantation** yielding so good bark, as the 60,000 trees which McIvor reared from the one tree which I gave the Indian Government. This I have abundantly described as the *C. Uritusinga* of Pavon, and the seed was sent me together with botanical specimens from the mountains of Uritusinga. The bark sent me by McIvor exactly reproduces in appearance that from Uritusinga. I have given the analysis of the different generations, and now the bark has yielded me equal to 7·50 per cent. of beautiful sulphate of

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* I take no notice of small importations of good *Calisaya* from British India, nor of the *renewed* Red Bark, which is a complete success.

quinine*—the alkaloid existing in this bark in a state particularly easy to separate and purify. It appears to have the advantage over the other forms of *officinalis*, except the *angustifolia*.

For another striking illustration of the above statement, I should refer to the *C. Calisaya* var. *Ledgeriana* in Java. Of course the genealogy of this tree is perfectly known, and has been described in my "Quinology." There is not the smallest reason for supposing it a hybrid, and the exceedingly rich production of pure quinine alike in the three forms I have given, stamp it as a peculiar species, for as I have shown in my analysis of the *Calisaya Anglica*, a real hybrid partakes of the qualities of *both* parents, and here the constitution is *unique*, as under:—

	A *Form.*		
"Quinology," page 59.	Quinine . . .	9·06	
	Amorphous .	1·40	
			10·46
	Cinchonine .		0·10
			10·56
	B *Form.*		
Ditto, page 60.	Quinine . . .	9·91	
	Amorphous .	2·09	
			12·00
	C *Form.*		
Ditto, page 60.	Quinine . . .	9·97	
	Amorphous .	1·70	
			11·67

The small *white* flowers, bearing no resemblance to any but those of *C. micrantha*, are also highly characteristic. M. Moens writes me on receiving my "Quinology," "the plates are very beautiful and the plants well represented; as your artist had to make them after dried specimens,† the colour of the leaves and of the flowers is sometimes a little different from that of the living plants. So in Plate IV. the colour of the under side of the leaves is too blue, and the flowers have a reddish or brown hue, whilst those of the tree (now dead) were white with a very light yellow tint. Plates V. and VI. are excellent, as also VII. and VIII."

All this is exactly the opposite to what Kuntze says, p. 239, "ferner steigert sich überhaupt der Chiningehalt mit der hybridität," of which assertion, as usual, he gives no proof. He also says,

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* "Quinology of the East Indian Plantations," page 83.

† This does not apply to Plates IX., X., XI., XII., which were from living plants.

"the darker the colour of the flowers, the richer in quinine is the bark." But it would occupy too much time to point out all the errors into which he has fallen.

It seems to me that what we need is not so much fresh classification, as the observation of actual facts, on which true classification may be founded. The genus cinchona does not differ as to its polymorphous character from various other families, and in these it has been well shown that constant hybridism produces a perfect chaos of forms—unstable and liable to revert to the original species. This is not an ordinary condition of things in the native places of growth of the cinchona, as the different forms are ordinarily very much localized and very distinct. It is possible that in the Yungas of Bolivia, where several typical forms are found together, and bees are said to abound, the case may be different. On the whole, this family of plants appear to me to exist in a great number of *nearly allied but permanently differentiated forms*, ranging themselves around central groups, having strongly marked physical specialities which can be appreciated even more fully by chemical analysis than by botanical distinctions. These do not appear to have been produced by hybridization, neither do they correspond with the commonly received notion of species and varieties. The careful French botanist, M. Alexis Jordan, has, in the course of some thirty years of observation and of experimental cultivation, arrived at similar views in reference to other genera of plants.

Those who would cultivate successfully must be guided rather by carefully conducted experiments than by unsubstantial theories.

The President said this was a paper from a gentleman who had devoted perhaps more attention to this subject, and had more successfully studied it, than any other living man; he had published very largely upon it, and his suggestions were entitled to the very greatest respect. Mr. Howard, with many others, was impressed with the importance of preventing the extermination of these valuable trees which were the only sources from which the cinchona alkaloids could at present be obtained. In South America no special attention had been given to the keeping up of the plantations, and destruction appeared to have been going on for a length of time; and although means had been resorted to by the English Government in India and by other governments elsewhere to develop the cultivation of these trees, Mr. Howard seemed to think that something of the same sort ought to be adopted in South America.

A vote of thanks having been voted to Mr. Howard,

Professor ATTFIELD said it seemed quite astonishing, considering what had been published with regard to the therapeutical value of the cinchona alkaloids other than quinine, that they should not have come into more general use. Experiments had been conducted on a large scale in India, and from the reports put forward by medical men there seemed to be no question of the value of these other alkaloids; but though they were used to some extent, it was remarkable that they were not employed more generally. It appeared to him that the pharmacists present might perhaps suggest some means by which this desirable result could be secured. Substances with fanciful names which did not indicate their composition in any way had got widely known by means of advertising, and it occurred to him that if Messrs. Howard would condescend to push these preparations as other men pushed their wares they might be brought more generally under the attention of medical men.

Mr. WILMOTT said the difficulty of introducing any other alkaloid in place of quinine was very great. This no doubt arose partly from the fact that there was a certainty about quinine which the other alkaloids did not appear to possess. Messrs. Howard not long ago kindly sent him a large bottle of citrate of cinchonidine and iron, which he endeavoured to introduce into King's College Hospital in the place of quinine and iron, but found it was quite hopeless, and the bottle remained unopened. He regretted this, because if cinchonidine was really of the same value as quinine the saving of expense would be of great importance in the case of hospitals and similar public institutions. He had no doubt, however, that such exceedingly able papers as they had just heard would go far to remove the prejudice which existed.

Dr. SYMES stated that Messrs. Howard had published a pamphlet on the subject of these alkaloids and would willingly supply them to any pharmacists who could make use of them. He was glad to say that at least two hospitals in Liverpool were now using citrate of iron and cinchonidine.

Dr. PAUL thought it was not altogether a matter of commercial enterprise to bring these alkaloids into use. Messrs. Howard had laboured actively for some years to introduce especially the sulphate of cinchonidide, but their efforts had been to a great extent fruitless. It was not because these alkaloids were unknown or inaccessible, for both Messrs. Howard and Mr. Whiffin made sulphate of cinchonidine almost perfectly pure at 2*s.* an ounce, and several German makers also turned it out in large quantities, but still it was hardly ever prescribed. It was not open to the same objection as the amorphous alkaloid in the making of the scale preparations, where the disagreeable taste of that body was a bar to its use, for citrate of iron and cinchonidine was quite as pleasant to the taste as the preparation of quinine. It appeared to him that before the use of cinchonidine instead of quinine could be looked for, some authority required to be furnished for its use as a medicine; if for instance, the College of Physicians would authorise its use, medical men would be more disposed to prescribe it. The result of the commission appointed in India showed that sulphate of cinchonidine was scarcely inferior to quinine in the class of fevers for which it was principally used. He might mention as a practical result of the introduction of the barks now being used, that they might not improbably look for the introduction of cinchonidine in a rather objectionable form, namely as an admixture, perhaps 10 or 20 per cent., with the sulphate of quinine of commerce. This already existed to some extent, he was sorry to say.

Mr. Benger said he had been supplied by Messrs. Howard on two occasions with a large number of samples of cinchonidine, which he had distributed amongst the medical men of Manchester, but with very small result in the shape of prescriptions. Some gentlemen to whom he introduced it prescribed it for a short time, but then discontinued it, probably from forgetfulness. Several professional gentlemen told him they believed it answered as well as quinine, but no better, and they preferred quinine, as they had always been used to it.

Mr. E. Smith, as the result of his experience, found there was great difficulty in inducing medical men to use anything which came from bark other than quinine. He struggled very hard at one time to introduce muriate of cinchonine and sulphate of cinchonidine, but to no purpose; and he did not see how the difficulty could be got over except by making cinchonidine fashionable, and the best way to do that probably would be to put a high price and a fancy name upon it.

Mr. Payne (Belfast) suggested that these alkaloids should be introduced into the next edition of the Pharmacopœia, and so made official preparations. He had had medical men apply to him for some substitute which would do as well as quinine, and on suggesting to them sulphate of cinchonidine they had reported that they could not see any difference in its action.

Mr. Groves remarked that it was very unpleasant to them all to have to put their hands so deeply into their pockets on account of the present price of quinine, but he derived some consolation from feeling that this high price must compel doctors to give a fair trial to the cheaper alkaloids. It occurred to him that as an enormous quantity of cinchonine and cinchonidine must be made as bye-products in the manufacture of quinine, these bodies must be accumulated to an enormous extent, unless indeed they were introduced into practice surreptitiously.

Mr. W. D. SAVAGE said he had recently induced a large public institution with which he was connected to introduce cinchonidine owing to the present high price of quinine, although he had failed to do so before.

Mr. EKIN remarked that Mr. Howard had referred to the great increase in the yield of alkaloid from the cultivation of the plants; and notwithstanding this was still rather a moot point, he believed that cultivation properly carried out had that effect, and he was therefore surprised to hear a gentleman state that morning that, in the case of aconite, cultivation distinctly lessened the amount of alkaloid formed in the plant.

The PRESIDENT remarked that that was probably because the proper mode of cultivation was not understood.

Mr. GERRARD said amorphous alkaloid of the cinchona bark was extensively used at University College Hospital amongst the out-patients, for one year entirely, and it was found to be a valuable tonic; but it was also an emetic, and therefore it had to be discontinued.

Mr. PLOWMAN said that the sulphate of cinchonidine had been used in St. Thomas's Hospital for a considerable time. It was decided some time ago to substitute it for sulphate of quinine in all ordinary tonic mixtures, but not where it was given as a specific in fevers. It was also used with citrate of iron; and its consumption was now ten times that of quinine. Whenever quinine was intended to be used, it was the custom now to underline the word.

Mr. MANBY was quite certain, from considerable personal experience, that the alkaloids of quinine had not the same effect in a multiplicity of diseases as the original cinchona bark. Whether this was because certain properties were destroyed in obtaining the alkaloids, he could not say; but he was quite satisfied that in the case of the agues prevalent in some counties a decoction of the bark had a much more beneficial effect than quinine.

Mr. MAITLAND said he had often had occasion to take sulphate of quinine, compound tincture of bark, and so forth, but had received most benefit from aromatic sulphuric acid combined with well made compound tincture of bark. He might also mention that he did not find headache or constipation arise from taking cinchonidine to so great an extent as from quinine.

Mr. Greenish said he had quoted from the ablest writer on the subject, Professor Schroff, in his remarks on the effect of cultivation of the aconite plant.

Mr. Umney said there could be no question that India was the great field in which quinine and other cinchona alkaloids were tried. In the *Lancet*, about twelve months since, a report was published from a leading surgeon (he believed in Bengal), which stated that cinchonidine was almost valueless as compared with quinine. When there were such contradictory statements as to the value of these bodies they could not expect medical men at home to take them up, except for further experiment. He had no doubt the time would soon come when East Indian cinchona barks and their alkaloids would be introduced into the Pharmacopœia, for they were already largely used in manufacture. Very little fluid extract was now made from calisaya bark, which of late years had much deteriorated, some specimens of which would not contain more than two or three per cent. of total alkaloids, whereas the bark of *Cinchona officinalis* (East Indian) contained as much as six per cent. of quinia and yielded a fluid extract far superior to any made from the finest calisaya bark. The same remark applied to the East Indian *Cinchona succirubra* bark, which was now largely used.

Mr. Siebold thought the non-success of pharmacists in their attempt to introduce these alkaloids to the medical profession was due to their efforts being isolated; if they would all agree to use their influence with those medical men whom they knew, they might be more successful.

Mr. Schacht ventured to utter one word of protest against what was now proposed, for he thought it hardly becoming on their part to urge any particular article on the medical profession, if such article were not the best; and with all the laudation which they had heard of cinchonidine and the other alkaloids, no one had ventured to say they were better than quinine. In that fact lay, he believed, the whole explanation of the phenomena on which they had been commenting. A medical man should use the best thing he could get, and the mere difference of a fraction of a penny or a farthing in the cost per dose ought not to influence him. Whether quinine, cinchonine, or cinchonidine, or all the alkaloids in combination, represented the whole medical qualities of the bark, was another question, but he thought it better not to discuss that now.

Mr. LAWSON TAIT (Birmingham), as a medical man, was bound to say that the difficulties which had been referred to existed in the minds of those who used as well as of those who prepared these alkaloids. In the cinchona bark there were a great many different properties, and from a long hospital experience he was quite satisfied that results were to be obtained from a decoction of bark which were not to be derived from either of the alkaloids. He had had no experience in hot countries, but within a few days he had been called upon to treat a case of ague in the person of a friend who had been long practising in Bengal. He gave him 10 grains of quinine, and the result was the disease was cut short and did not return, which it would have done, being quotidian ague, if the quinine had not been efficacious. At the same time he did not believe quinine alone was a tonic, for he did not find it to act as such in the case of many patients who came under his care.

Mr. BURTON said the result of long observation on his part showed that a decoction of bark was often more effectual than quinine. He had known cases in which persons suffering from ague had been cured by the bark when quinine had produced little or no effect.

Dr. PAUL remarked that a distinction should be drawn between the specific virtues of different constituents in the bark. The value of the astringent principle as a tonic had been long recognised and by some physicians was considered by far superior to quinine; but, on the other hand, quinine had a specific value for certain purposes, and if the result of the medical commission appointed in India was to be accepted, the value of cinchonidine was about 80 per cent. of that of quinine. As an immense quantity of bark was now produced which contained only about 1 per cent. of quinine, with 3 per cent. of cinchonidine, it was a very practical question whether the value of that 3 per cent. was to be abandoned because this bark could not be used for making quinine.

The PRESIDENT said they could not anticipate that anything they could say there would tend to deprive quinine of its pre-eminence. There had, however, been a great deal of testimony from medical men that effects were produced by the preparations of cinchona bark which neither of the alkaloids separately was capable of producing. He thought possibly medical men would be more likely to try these other alkaloids if the whole of them were converted into a soluble salt and recommended for use. The effects he referred to might be due to something beyond the alkaloids, but at any rate a preparation containing the whole of the alkaloids seemed to be a desideratum, and might be more readily introduced than they could separately.

Mr. WILLIAMS remarked that such a preparation as the President had referred to already existed under the name of quinetum, manufactured by Mr. Whiffin.

Mr. MARTIN did not find there was any great difficulty in introducing cinchonine or cinchonidine to the notice of medical men and getting them to try them; but the next time they prescribed they went back to quinine, no matter what the price was. Whether this was for want of an authoritative voice to speak in its favour, or from any defect in the alkaloids themselves, he could not say; but in the North of England quinetum was considered to be merely a diluent of quinine.

Mr. SILSON (Bradford) observed that one great channel of consumption of quinine seemed to have been overlooked, viz. the purchase of the public themselves. It was astonishing the number of people who had an idea that quinine cured everything, and who came for it whatever ailed them.

The title of the next paper read was—

NOTES ON AN IMPURITY IN OXIDE OF ZINC.

By W. W. STODDART, F.C.S., ETC.

A few weeks ago I had a sample of oxide of zinc sent to me for analysis. It was bought for mixing with white lead as a paint, but on being ground was found to be nearly useless, It would not readily combine and form a homogeneous mass, as usual, nor would it give the "body" required. In fact, it was so unsatisfactory an article that it was laid aside and another used in its stead. Some objection was raised to its being returned, and caused the firm to have it examined and the cause of failure ascertained.

I have brought the subject before your notice, not on account of the peculiar impurity, but because it has a pharmaceutical interest, for it answers well to all the pharmacopœial tests for pure oxide of zinc, and yet it is impure to the extent of nearly 10 per. cent.

The sample was nearly white with a very slight buff tint. Like the pure oxide it became a strong yellow when heated, regaining its former whiteness when cold. It was perfectly and easily dissolved in an excess of carbonate of ammonia, and the alkaline hydrates. From the alkaline solution a white precipitate was produced by sulphide of ammonium. It dissolved without effervescence in dilute nitric acid, and was so little affected by chloride of barium that after standing for several minutes the milkiness was so slight as to require a close scrutiny for its recognition.

If, however, the solution in nitric or hydrochloric acid be made in a flask, a strong odour and copious evolution of sulphurous acid gas becomes very evident.

A few grains were placed in dilute hydrochloric acid with a small piece of pure zinc, when sulphuretted hydrogen was evolved, and speedily became evident with the help of a bit of lead paper.

The addition of chlorine water produced a distinct precipitate of sulphate with chloride of barium.

The use of nitro-prusside gave a red colour with a little of the solution to which a little soda and acetic acid had been added.

An analysis showed that the sample was composed of oxide and sulphite of zinc in the following proportions:—

Oxide of Zinc	90·87
Sulphite of Zinc	9·13
Sulphate of Zinc, a very slight trace.	
	100·00

The trace of sulphate was so small that it was probably due to oxidation of the sulphite. The cause of the presence of sulphite of zinc is not quite apparent, but the sample came from a continental house, and was very likely manufactured from a sulphide of zinc in some rapid and imperfect manner, which had partially oxidised some of the sulphide, and produced the impure product of which complaint had been made. The appearance of the sample suggested a process by heat rather than by precipitation.

The President said it was new to him that oxide of zinc was ever met with contaminated with the sulphite, and he could not see what the source of such oxide could be.

Mr. Williams thought it must be accidental.

Professor Attfield said he had heard it stated that so-called oxide of zinc was made on a large scale by roasting the native sulphide; now every worker at quantitative analysis who had endeavoured to convert his two or three grains of sulphide of zinc into oxide by roasting, must know that it was difficult to do so entirely without a trace of sulphide remaining.

The PRESIDENT asked what sulphide of zinc could be used for the purpose. He knew of no native sulphide of zinc that would yield anything approaching to the kind of compound alluded to, as it was always contaminated with iron, and also largely with manganese. If there were an artificial sulphide of zinc produced in any quantity this might account for it.

Mr. WILLIAMS said sulphide of zinc was produced for the purpose of vulcanizing india-rubber; but it was rather an expensive thing compared to oxide of zinc, and he therefore could not suppose that that was the source of the impurity in question.

Dr. R. OXLAND suggested that the sample examined by Mr. Stoddart might possibly have been the result of an attempt to decompose sulphate of zinc by some hydrocarbon combined with exposure to heat. He could imagine that passing carburetted hydrogen over sulphate of zinc at a certain temperature would produce oxide of zinc and a sulphide.

The PRESIDENT said the oxide of zinc used for making paint was made by the old method of burning.

Dr. OXLAND said a large quantity of sulphate of zinc was produced in the process of autogenous soldering, in making lead chambers; perhaps an attempt had been made to utilize the sulphate thus obtained, and convert it into oxide.

A vote of thanks to the author was passed.

The next paper read was a—

SUPPLEMENTARY NOTE ON THE ASSAY OF OPIUM.

By B. S. PROCTOR.

Since the publication of my former note on this subject, I have recorded two or three small matters which I now offer for your consideration.

The process as described at our last meeting was devised with the object of being at once accurate and speedy. One ground upon which I advocated its preference to other modes being that a sample of opium from a chest could be assayed and its value determined in the course of a couple of days—most other processes making any pretensions to accuracy requiring considerably more time; such for example is the case with the process described by Mr. Cleaver at the same meeting, the opium having to be dried, powdered, and exhausted with benzin before the extraction of morphia is commenced.

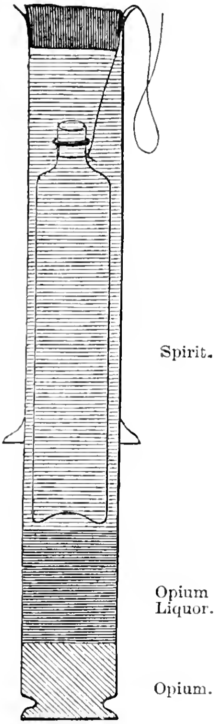
With the view of further expediting the extraction, I have modified the mode of operating thus:—

Rub the lump opium with its own weight of water, to as smooth a pulp as possible, if necessary with the aid of a gentle heat; add spirit equal to about three times its weight, and transfer to a percolator tube which is furnished with a loosely fitting inner tube, closed at both ends for increasing the hydrostatic pressure.

A phial filled with water and corked answers well for the inner tube, a string being tied round the neck, by which it may be let down gently till the bottom of the phial just touches the surface of the opium liquor.

Its position may then be fixed by pressing the string between the side of the tube and a cork wedge. When thus arranged, more spirit may be added, till a column of 6 or 8 inches is obtained without disturbing the marc or mixing to any appreciable degree with the opium liquor, and without using more spirit than is required for the exhaustion of the opium.

To quote one experiment in illustration: 200 grains of a soft sample of Turkey opium treated thus, a head of 8 inches pressure was obtained. In four hours, four ounces of percolate had passed through, which contained 98 per cent. of the morphia present; another ounce was considered to have effected practically a perfect exhaustion. Other trials gave similar results.



In assaying sundry samples of opium by the method I have recommended, I have occasionally met with specimens which deposited along with the morphia, a white amorphous substance which could be washed out only by long-continued washing with spirit, strong or dilute.

These specimens I have assayed by the lime process and by the acetate of lead process (in conjuction with the above mode of extracting), but without quite satisfactory results.

Upon the whole, I find it most advantageous to cut the washing short when I find such impurity present, dry the precipitate, wash out the narcotine with benzin as usual, and then redissolve with hydrochloric acid and spirit, and reprecipitate with ammonia, which treatment I have never found fail to give me well crystallized and nearly white morphia of almost absolute purity. If the quantity of spirit and water used for solution be limited to two drams of each (the quantity I find desirable for an operation upon 100 grains of opium), and the washing be not unnecessarily prolonged, one quarter grain may be allowed for the loss in purification. I find the solution by spirit and acid followed by reprecipitation is both more convenient and less wasteful than crystallization from boiling alcohol, which has been recommended by some analysts; and I find the loss of time is not necessarily great, for the morphia goes down with more promptness and certainty from this approximately pure solution than when deposited from a liquor containing the soluble extractive matters of the opium. Three to four hours are sufficient in the former case, while eighteen to twenty are desirable in the latter.

I have found in sundry cases that the precipitation of the morphia from solution in *strong* spirit and acid is advantageous, inasmuch as the crystals are whiter, larger, and sooner washed clean; but my experience is too limited yet to say whether the strong spirit is generally preferable. When rectified spirit is used, without water, for the solution from which the morphia is to be precipitated, a larger correction must be made for the quantity of morphia retained in the mother liquor.

Mr. Cleaver, at the Glasgow Conference, regarded his washings as saturated solutions of morphia, and pointed to the defectiveness of my process in not making a similar estimate of the loss of morphia in my washings. I thought it more reliable to make a total correction for the loss of morphia in the mother-liquor and washings founded upon sundry experiments where the actual loss of a known quantity of pure morphia similarly treated was ascertained. He regarded the washing water as a saturated solution of morphia, and quoted evidence in support of the supposition. It appeared to me theoretically improbable that the washings should be saturated, and I have not been able experimentally to determine their degree of saturation, as he did with fusel oil. Of course, my failure is my fault and not his; but I have varied the experiment, and washed 8·6 grains of pure morphia with a pint of water, and found it had lost only 1·4 grains, instead of being entirely washed away, as it should have been if Mr. Cleaver's estimate (that the washing waters contain $\frac{1}{1000}$ of morphia) had been correct. I would not be so bold as to assume that the proportion of morphia in the washing waters generally was in the ratio of 1·4 grains to a pint; but I think it is safe, after sundry experiments, to assume that the loss of morphia in the mother-liquor and washings, when the process is performed as I have described, amounts to 0·2 to 0·25 grain.

Some analysts recommend the washing of the precipitated morphia with a small quantity of chloroform, as well as with ether, benzin, or spirit. In sundry experiments I have found the loss involved by its use to be very trifling, but I have limited its quantity to a fluid dram or two; and in those cases where the washing with spirit and benzin did not readily remove the impurities, the chloroform also failed to do so unless used freely; and as its solvent action upon morphia is much greater than that of ether or benzin, the estimation of the morphia washed away by its use becomes more important, at the same time that it is more troublesome.

It is unnecessary for me to quote in detail the precentage of morphia I have found in the samples I have met with in the ordinary course of trade and analysis, but I may mention briefly that my experience corresponds closely with that of Mr. Dott, published in last year's Transactions, except that my results are in general a little lower, and conspicuously so in one or two cases. Thus, his lowest percentage of morphia in Turkey opium is 6·9, calculated upon the drug in its moist state; while I have met with one good-looking sample, offered me as of best quality, which contained only 3·5. I also find that 11·2 is the highest percentage of morphia I have found in Turkey opium in its fresh moist condition.

The requirement of the Pharmacopœia that opium in its moist condition should yield 6 to 8 per cent. of a crude precipitate of morphia by a given process has frequently been criticised as being too low. I scarcely think that 8 per cent. should be considered too low if a *pure* morphia be obtained, and the sample contains a usual quantity of water; but it would be more satisfactory to say definitely that the opium for pharmaceutical use should contain within a fraction of a grain, more or less, of 10 per cent. of morphia calculated upon the drug in its dry condition. According to present rule a poor sample of opium may be brought up to "Pharmacopœia standard" by partial drying, while the same standard would not exclude another sample of double strength tested in its moist condition.

Basing the calculation upon the dry opium has the further advantage that it is its morphia value in this state which determines its medicinal activity when administered as powder, compound powder, tincture, etc.

The percentage of water in moist opium I have found to vary from 19 per cent. to 27 per cent. Mr. Dott's table agrees closely with my observations in this particular, if we omit one anomalous sample which he found to contain 31·2 per cent. of water, and only 20·1 per cent. of aqueous extract.

In conclusion, I may note that the degree of dryness to which an analyst reduces his sample considerably exceeds that to which the bulk is reduced by the drug grinder. Powdered opium, fresh from the mills, loses 5 to 6 per cent. of its weight by further drying.

Dr. Paul said he had frequently made attempts to extract opium within a reasonable time by the method of percolation, but had never succeeded in getting a result worth anything, in the time required; for this he had tried all kinds of devices, he could never get the extraction quickly enough. With regard to the correction for morphia remaining in solution, or washed out in the process, he thought great care should be exercised in laying down any specific co-efficient for so much morphia dissolved in so much mother-liquor, or removed by washing, because the extent to which alkaloids dissolved in different solvents varied very much according as they were going into solution on passing out. This was very marked in the case of some of the quinine alkaloids; for instance, sulphate of cinchonine could be evaporated until it was quite syrupy without crystallizing; but when it was in hard crystals, like sulphate of potash, it was equally difficult to dissolve it in five or six times the quantity of water absolutely necessary for holding it in solution.

The thanks of the Conference having been accorded to Mr. Proctor, the following paper was read,—

SUGAR IN PHARMACY.

By Charles Symes, Ph.D.

Of the many thousand tons of sugar refined weekly in this country, in addition to that so imported, but a small portion enters into the domain of pharmacy; and hence, whilst volumes have been written on the various processes and treatment which it undergoes, from the source of its production till it reaches the table of the consumer, but little of this literature has dealt with the subject from a pharmaceutical point of view. Perhaps pharmacists feel it to be too insignificant a substance, void of medicinal value, and therefore not meriting attention. Yet sugar is an article of the Pharmacopœia, and as an adjunct, excipient, and preservative plays an important part. It does more than this; by entering into chemical combination with certain other substances it increases their potency, a familiar example of which we have in saccharated lime water, and perhaps less familiar, its compounds with iron, etc., some interesting experiments on which are described by Dr. Gladstone (*Journ. Chem. Soc.*, vii., 195). When used mechanically to divide the particles of other bodies, it also tends to increase their medicinal activity. Triturated with calomel we have this result most markedly; in other cases it is merely protective, saccharated carbonate of iron affording us an example in which it retards, and in a great measure prevents peroxidation. In solution it forms the best vehicle for the administration of nauseous medicines; it is a solvent of certain active principles, such as those of peruvian bark; also a preservative of certain flavouring agents, and of some chemical substances, notably the proto-salts of iron.

But it performs these offices in a satisfactory manner only when certain conditions are observed, and only so long as itself remains unchanged; for if fermentation once sets in, destruction of the syrup, together with the substance it was intended to preserve, is almost sure to result.

It is perhaps scarcely necessary to remark that in the selection of sugar for syrups, purity is of the first importance; this object fortunately it is not difficult to attain. Good lump sugar, such as Say's, crystals such as were formerly produced by Finzel, now by Tate & Son, or granulated such as is sent out from the Eastern Sugar Refinery, Boston, and imported into this country in casks of about 2 cwt. each, are all practically pure sucrose; the ash yielded by either is not more than from three to six parts in 10,000 (representing about double that quantity of mixed potash and lime salts), and a mere trace of glucose. There appears to be a decided prejudice against sugar produced from the beet for use in pharmacy, which arises probably from the fact that the crude article is much more impure than that derived from the cane, but this is not necessarily so in the refined product; a more elaborate process and greater care in the refining are necessary, but we have really nothing to do with this, and should look only at the results. Now, Say's lump, which is largely, and for months in the year exclusively, prepared from beet, is regarded in the sugar trade as a standard of purity. The prejudice, however, is not altogether unfounded, for unless beet sugar be thus perfectly refined a trace of volatile oil is liable to remain, also a trace of nitrate of potassium, which is probably the source of a minute quantity of nitric acid when in solution. Sugar thus impure is rejected by the confectioner, as it is found to decolorize some of his goods, and of course would be unsuitable for pharmaceutical purposes. Solubility stands next in importance to purity, for it is a well-known fact that under the prolonged action of a large bulk of water it becomes inverted, and this is accelerated by heat.

Some pharmacists always use sugar in large crystals, under an impression that it is the purest; it is, however, only equally pure with the other kinds I have mentioned, and possesses the one disadvantage of being the least readily soluble, whilst the granulated is superior in this particular to both it and the lump; indeed, in my opinion, it is the best and most convenient for preparing pharmaceutical syrups, especially as an important point we have to avoid in the preparation of these is invertion, *i.e.*, the breaking up of the sucrose molecule, $C_{12}H_{22}O_{11}$, with the appropriation of a molecule of water, H_2O, into two molecules of glucose, $2\,C_6H_{12}O_6$, which is the first stage in fermentation; and although this is not a necessary sequence, it is much more likely to occur when the first stage of the process is already accomplished.

If we have a very soluble sugar to deal with, agitation with cold distilled water will soon produce a syrup of full density and good quality; with a less soluble one the application of heat becomes necessary. But it is better to add the sugar to the water already at the boiling point than to slowly heat the two up to that temperature, as is the usual method; we thus quickly obtain a concentrated solution and avoid the prejudicial influence of continued heat on a weak one.

Syrups containing acids are affected in the cold, but still more readily as the temperature increases. Some acids act more prejudicially than others, but inversion to a greater or less extent always takes place. In 1874 Arno Behr published a table of the inverting power of acids on sucrose at various atmospheric temperatures, which, being of considerable interest to pharmacists, I will here reproduce. The action of hydrochloric acid is taken as the standard at 100.

It will be seen that acetic acid has the least, nitric acid the greatest, inverting power, and that phosphoric acid stands high in the scale.

Inverting Power of Acids on Sucrose. (Arno Behr.)

Acid.	211 hours 13°–17° C.	115 hours 19°–27° C.	78 hours 25°–27° C.
Acetic Acid	1·2	1·3	1·6
Butyric ,,	—	1·9	2·5
Isobutyric ,,	—	2·2	2·5
Succinic ,,	—	3·5	4·0
Malic ,,	—	8·1	8·8
Citric ,,	8·2	9·2	10·2
Formic ,,	—	9·2	9·6
Lactic ,,	10·2	10·4	9·9
Tartaric ,,	11·4	13·4	13·8
Phosphoric ,,	24·2	25·8	26·9
Oxalic ,,	49·6	53·1	54·5
Sulphuric ,,	83·9	83·1	84·2
Hydrochloric ,,	100·0	100·0	100·0
Nitric ,,	100·1	100·4	100·1

The bottles from which syrups are dispensed should be well washed each time before they are refilled; or, to follow the example of some of our continental brethren, syrups, such as those of orange, lemon, etc., should when prepared be put into half-pint or one pint bottles (quite full), and stored in a cool dry place with little if any light, one bottle being kept in the pharmacy for use and *replaced* not refilled, by another when empty, thus avoiding the admixture of the fresh supply with a small quantity of that which has been exposed to air and warmth for some time, and which has usually undergone a partial change, otherwise the proverb that "a little leaven leaveneth the whole mass" is fully illustrated by the result. There are certain syrups which from being rarely used are sometimes found to be spoilt when required, such for example as syrups of saffron and roses. This difficulty can readily be overcome by making concentrated liquors from the saffron, roses, etc., respectively, filtering on to granulated sugar contained in a water bath, and drying with frequent stirring at a gentle heat. These products keep well in closed bottles, and the syrups can readily be extemporized from them as required. There are doubtless several others which could with advantage thus be prepared; but the above are the only ones with which I have had any length of experience.

Sugar is not only useful in preserving the proto-salts of iron as syrups, but added to the water in which they are precipitated and with which they are washed, it exercises a protective influence; this possibly arises from the fact that saccharated water holds less air in solution than pure distilled water, and although sugar, as I have mentioned, acts readily on iron in the presence of oxygen, it does not combine with its oxide or salts.

I wish these remarks to be regarded not as an attempt to exhaust the subject, but rather as giving some of the results of my experience, with a view of eliciting further information and stimulating inquiry into a subject which to my mind merits a larger share of attention than it has hitherto received.

Dr. Oxland said he spoke as an old sugar refiner, though he had been out of the trade for many years. It was quite as possible to obtain pure sugar in this country, and even in that particular town, as in any part of the world. On examining the sample of Say's sugar now exhibited, he had reason to believe that it was decidedly inferior to the best English sugars. English refiners considered it *infra dig.* to use ultramarine for producing a good colour, but this was constantly done on the Continent, in order to disguise imperfections in the liquoring operation, which was the final washing in the centrifugal machine or otherwise, by which the last trace of impurities ought to be carried off. The fact of potash, silica, and lime having been found in the minute proportions referred to, would rather tend to show that ultramarine had been used. With regard to beetroot sugar, the very finest lump could be produced from it, and he had been the first to use it exclusively for that purpose in England. Before the employment of superphosphate of alumina as a refining agent in place of blood, only fifty per cent. of beetroot sugar, with an equal proportion of cane sugar, could be used, but now the finest loaf sugar could be made from beet alone, and he did not believe it would be possible to detect any difference chemically between it and cane sugar; the crystals, however, were a different shape, being about double as long as broad, instead of being nearly square, and having one or two lines down the middle.

A vote of thanks to the author was passed. The next paper read was on—

THE PROXIMATE PRINCIPLES OF THE NARCISSUS PSEUDONARCISSUS.

By A. W. Gerrard, F.C.S.

The natural order Amaryllidaceæ, to which the plant forming the subject of this notice belongs, has a reputation for producing many plants possessed of poisonous or active physiological properties; some are reported narcotic, others emetic and diuretic, whilst *Hemanthus toxicarius*, a native of Cape Colony, is stated to be used by the Hottentots for the purpose of poisoning their arrow-heads. As several of the Amaryllids are readily obtainable in this country, and our knowledge of their composition and physiological action being of a most meagre and unsatisfactory kind, I deemed them a matter worthy of investigation, more especially as Professor Sydney Ringer engaged to undertake physiological experiments with the substances I might obtain.

Narcisuss pseudonarcissus, or daffodil, is an early spring flower, well-known by its funnel-shaped perianth and golden corona, growing uncultivated in many parts of England. All parts of the plant are reputed poisonous, especially the flowers. At the time I undertook its examination, bulbs only were obtainable; to these, therefore, my observations were confined.

My first experiments were made upon a few bulbs, and gave indications of the presence of a substance possessing the characters of an alkaloid, and likewise therapeutic properties of an interesting order. A supply of twenty-six pounds of daffodil bulbs were furnished me, and at once reduced to a pulp, then exhausted with eighty-four per cent. alcohol. From the tincture obtained the spirit was removed by distillation, and the residual extract having some oily looking substance floating on its surface was washed with ether; the ether removed and evaporated, gave a residue of oil and resin, odorous, acid, and partly volatile.

The mother extract was now made alkaline with potassic hydrate, and again treated with ether. The ether layer, decanted and allowed to spontaneously evaporate, yielded a yellowish brown viscous substance, the surface of which displayed several masses of crystals; these masses were half an inch in diameter, and composed of extremely delicate needles radiating from a common nucleus; the reaction of the mass was alkaline. I was much pleased with its appearance, and expected to find the crystalline matter an alkaloid, but in this I was disappointed, as the following experiments will explain.

A small quantity of water was added to the partly crystalline mass, and sufficient nitric acid to render it neutral; the crystalline matter remained undissolved, but imbedded in a blackish oily substance; and the separation of the crystals from the oily matter has defied my best efforts. Benzole, carbon disulphide, chloroform, and alcohol, each dissolved the oil, likewise the crystalline body;

when the matter was shaken with water a few crystals disentangled themselves, but not in sufficient quantity for a proper examination. A few of the crystals obtained were placed upon a watch glass and treated with solution of caustic potash, which only dissolved them when warmed. A few crystals placed in the mouth appeared tasteless. The yield of this crystalline substance, which I am inclined to regard as a neutral principle, I should imagine was not more than five grains from the whole of the bulbs employed, and as I had now consumed it all in my experiments, I was compelled to discontinue its examination.

My attention was now directed to the nitric acid solution of the alkaline matter; it possessed a decided bitter taste, and gave, from moderately strong solutions, precipitates with phosphomolybdate of soda and nitric acid, tannic acid, iodohydrargyrate of potassium, perchloride of platinum, sulphocyanide of potassium, and solutions of potash, soda, and ammonia; with the latter it dissolved in excess. By these characters, therefore, I am able to establish the identity of an alkaloid, which, provisionally, may, I think, be termed pseudnarcissia. I have found it soluble in water, ether, alcohol, chloroform, and benzole, from none of which solutions has it crystallized, but formed a transparent yellowish brittle substance. The yield of this alkaloid is very small, about six grains from the pound of bulbs, but it must be borne in mind that fresh bulbs consist very largely of water, and that alkaloids very soluble in water are never completely extracted from their mother-liquors by ether or like solvents.

The whole of the nitrate of pseudnarcissia being required for Professor Ringer's experiments, I was unable to carry its purification to a state of completeness, neither could I prepare its compounds with acids as I would wish to have done; a few drops of the nitrate solution placed upon a watch glass gave in about fourteen days some indifferent granular looking crystals.

After exhausting the parent liquor of its alkaloid soluble in ether, it was further shaken with chloroform, which solvent extracted some resinous colouring-matter and a minute portion of alkaloid, which latter was soluble in ether, and therefore I concluded to be pseudnarcissia. The same experiment as this latter was repeated with benzole and carbon bisulphide as the solvents, but they gave no residues worthy of notice; these experiments were undertaken as a search for other principles, which ether might not have abstracted, and which the different physiological actions of the daffodil extract and alkaloid point out as being present.

After exhaustion of the bulbs with spirit they yield to water a sweetish viscous extractive, not reducing alkaline cupric tartrate in the cold, but doing so immediately on boiling. Spontaneous evaporation of a solution gave no crystals. Various reagents were applied to this substance, but with no apparent effect, except the following, which is especially worthy of notice. The extract made semi-fluid, with water and caustic soda added, formed a yellowish mass, no longer fluid but semi-solid, and on agitation a most powerful odour of acetous ether was evolved, mingled with that of ammonia. The nature of this substance I cannot conjecture; I have plenty at my disposal, and should be glad to hand it to any gentleman who would undertake its further examination.

Professor Ringer's experiment upon the physiological actions of the alkaloid and spirituous extract—which will be published in detail elsewhere—show, that on warm-blooded animals the alkaloid given hypodermically in doses of three or four grains causes profuse salivation, with running at the eyes and nose, also free vomiting and slight diarrhœa, the motions sometimes being slimy. On man it was administered by the mouth, and found to act as on animals; sometimes the effects on the salivary glands are most marked; at other times it produces vomiting or diarrhœa, or both, without salivation; dropped into the eye it first slightly contracts and then dilates the pupil.

The extract in some respects is far more powerful than the alkaloid; thus, eight to ten excite nausea and vomiting, but produce no salivation. Hence it is very probable that the principle producing the salivation and that producing the emetic and purgative action are distinct. These latter points will be, if possible, determined, and my efforts will also be further directed to preparing the alkaloid in a pure and crystalline form.

A vote of thanks was awarded to Mr. Gerrard for his paper.

Professor ATTFIELD said that Mr. Atkins had sent in a paper on Pharmaceutical Ethics, which he would suggest should be read the following day without being discussed, lest they should get into questions of politics, which would be beyond the scope of the Conference. He would therefore take the opinion of the meeting whether this course should be adopted.

On the motion being put, it was carried *nem. dis.*, and the Conference then adjourned.

Wednesday, August 15th, 1877.

The Conference reassembled at 10 o'clock, when the first paper read was—

A GLANCE AT THE MATERIA MEDICA OF DEVON.

By Edward Smith, F.C.S.

I trust the title of my paper will not be misunderstood. It is not, of course, my intention, even were it possible within the limits of a short paper, to enter minutely into all the details connected with the various products of the county. Neither do I pretend to anything but a very incomplete knowledge of the subject. In this respect I must claim your indulgence, trusting that, as there must be many members present who have probably both a wider range of experience and more intimate knowledge of the county than I can lay claim to, some of you will fill up the gaps necessarily left open by giving us the results of your own observation and experience. I thought even a cursory glance at a subject of this nature might not altogether prove uninteresting to the many members attending the Conference from distant counties.

The pharmaceutical productions derived from the fauna of Devon are of the usual character. Taking the Pharmacopœia chiefly as a guide, we find mentioned in that work, eggs, suet, milk, lard, cod-liver oil, ox-gall, honey, etc. In eggs, suet, and lard, we have nothing special to offer. Our oxen are well known as "*facile princeps*" amongst their species, although our *fel bovis* is much as other ox-gall. Our milk does not differ materially from the general character of that secretion. It appears to have that singular affinity for water that seems almost to amount to a function. Our clotted cream, perhaps, deserves a special word. Devonians say you can't get cream out of Devon. But then the Cornish and Somersetshire folks say the same of their respective counties. It is, I believe, on record that a couple of weary travellers, having unwittingly crossed the border of Devon into Cornwall, and asking amongst other good things for a bowl of Devonshire cream, were supplied by the buxom hostess, much to the surprise of her visitors, with a mug of very attenuated milk. A vehement remonstrance brought out the truth, "Oh, you waants *Curnish* crame; I wandered at your askin for that puer Denshire stuff!" I am bound to say, however, that this Devonshire "stuff" is rather a toothsome tidbit, and especially so when strawberries are ripe. Although the cod-fish abounds on the Devonshire coast, I do not know of any important maker of cod-liver oil. With regard to honey, the amount produced in Devonshire is not nearly so great as might have been anticipated. Many of the smaller farmers and cottagers possess hives, but only to a very limited extent. Considering the great and special advantages offered by the moorlands, it is, I think, much to be regretted that a production, capable of being readily developed into a profitable business, is not more cared for and cultivated. Some few years ago I made an attempt to collect the honey in the Chagford district, but I found the amount procurable was too small to enable me to enter into any satisfactory business arrangements.

Passing now to the flora of Devon, we find here more material to work upon.

Of the Ranunculaceæ, *Aconitum Napellus* is found in patches in various parts of the county, though not to such an extent as formerly. Some few years ago it flourished luxuriantly in Dartington Park, near Totnes; but it has now disappeared from thence, owing, I imagine, to the poisonous character of the plant having been discovered. It is still to be found on the banks of the Dart, especially near Stoke Gabriel and near Staverton.

Of the Papaveraceæ, *P. rhœas* is common in the cornfields and roadsides. *P. somniferum* is not found, so far as I know.

The Cruciferous plants are represented by *Cochlearia armoracia*, common in the gardens, and sometimes in waste places among garden refuse. The three mustards are fairly common. *Sinapis alba* grows luxuriantly on the limestone soils; *S. arvensis* is common in cornfields, and *S. nigra* in the fields and roadsides.

Viola odorata, of the Violaceæ, is found plentifully; a white flowered variety is fairly common.

Of the Linaceæ, *L. usitatissimum* is found pretty abundantly. It grew luxuriantly during the summer about a mile from Torquay on the Paignton Road, also on the "New Cut," Torquay, and is found also near Totnes and Exmouth.

L. catharticum has been gathered near Torquay, and is also met with near Brixham and Paignton.

Rhamnaceæ.—*Rhamnus frangula* is found forming a part of the shrubs of the hedgerows near Paignton and Torquay. It is not uncommon in the Moreton and Tavistock districts.

Rh. catharticus is not, so far as I am aware, found in Devon.

Sarothamnus scoparius, of the Leguminosæ, abounds nearly everywhere throughout the county.

Of the Rosaceæ, *Rosa canina* is pretty ubiquitous in the county. *Potentilla tormentilla* is found frequently in heathy places about

Dartmoor. *Prunus laurocerasus* grows luxuriantly in the gardens. In some parts of the county the fruit is collected by the poor people and eaten as a delicacy, notwithstanding that Bentley says "the fruit is poisonous." It is also made into a most delicious jam or conserve.

The most important Umbelliferous plants are *Fœniculum vulgare*, found plentifully on the railway banks between Paignton and Torquay, and on the roadside between Teignmouth and Newton, and *conium maculatum*, which grows abundantly in the lanes around Torquay and many other places in the county. It may be gathered to an almost unlimited extent.

Caprifoliaceæ.—*Sambucus nigra* is the only medicinal plant of this order, and is common throughout the country.

Valeriana officinalis, of the Valerianaceæ, grows on the swampy ground near Watcombe, also in the neighbourhood of Newton, Tavistock, Plymouth, and other places.

The Compositæ are represented by *Anthemis nobilis*, a somewhat plentiful plant, being common near Torquay, Paignton, Milber Down, Bovey, and Tavistock.

Leontodon taraxacum is common everywhere. The roots of plants growing on limestone soils are not unfrequently dwarfed, and forked into several smaller rootlets, very unlike the strong, robust roots I have often gathered in the midland counties and elsewhere.

Of the Solanaceæ, *Solanum dulcamara* grows in the hedgerows almost universally. *Atropa belladonna* is a very rare plant. It has been found, I believe, near Combe Martin, North Devon. I have not met with it in Eastern Devon. *Hyoscyamus niger*, on the contrary, grows most luxuriantly in many parts of the county. Near Torquay, at Paignton, Dartmouth, Slapton Sands, and other places, an almost unlimited quantity could have been gathered during the season just passed. The Pharmacopœia directs the leaves of this plant to be gathered "when about two-thirds of the flowers are expanded." Speaking now of the wild plant, I do not agree with this. My experience points to an earlier gathering. If the collection be left until the plant has partly flowered, by far the largest and best leaves have, to a great extent, withered and become yellow and unfit for use. An earlier collection save all these. The resulting dried herb is, in my opinion, better in colour and in efficiency than if gathered later. Dr. Christison remarks, with respect to the activity of the leaves, "I have found them sufficiently active even in the spring, *before* the appearance of the flowering stem."

Datura stramonium is but rarely met with. Last year it flourished in a field between Paignton and Totnes, but has not this summer appeared in the same place. Several years ago a luxuriant patch grew near Stoke Gabriel on the Dart. This has since disappeared.

Scrophulariaceæ.—*Digitalis purpurea*, locally known as flap-dock, grows abundantly in every part of the county. In the woods near Moreton Hampstead it may be seen in most luxuriant masses, and when in bloom forms a charming addition to the landscape. The leaves of this plant should, I think, be collected before the plant begins to flower.

The three mints, *Mentha piperita*, *M. viridis*, *M. pulegium* represent the Labiates. *M. piperita* is found at Cockington, near Torquay, also at Ashburton, Chudleigh, and other places.

M. viridis is somewhat rare, found in marshy places around Exmouth. *M. pulegium* is found in swampy places, as Forde Bog, near Newton. This herb is called in the Devonshire dialect "organs" or "argans." The origin of this word I do not know. In a poem in the Devonshire dialect, published in 1867, these lines occur:—

> "Jist put her tooties in hot watter,
> An' gi 'er a few strang *argans* arter,
> Or else some featherfoul."

That is, "put her toes in hot water and give her a little strong pennyroyal tea after, or else some feverfew."

Daphne laureola alone represents the Thymelaceæ. It is found in the woods between Paignton and Totnes, and several other localities.

Cannabinaceæ.—*Humulus lupulus* is occasionally found, apparently wild, in the Cockington lanes near Torquay; it flourishes also at Goodington, Paignton, Brixham, etc.

Ulmaceæ.—*Ulmus campestris* and *Ulmus montana* are common throughout Devon.

Salicaceæ.—The various willows flourish abundantly throughout the county.

Cupuliferæ.—*Quercus robur* is very abundant in our woods.

Moraceæ.—*Morus nigra* is found cultivated in sheltered gardens in Torquay and neighbourhood.

Coniferæ.—*Juniperus sabina* also flourishes in many gardens and shrubberies as a cultivated plant.

Colchicaceæ.—*Colchicum autumnale* is a rare plant, at least in Eastern Devon. At one time it flourished near Torquay, but has now disappeared.

Filices—*Lastrea filix mas* flourishes luxuriantly throughout the county, and is a very common plant.

With regard to the Inorganic Materia Medica, I propose to restrict this paper to a notice of the *minerals* of Devonshire, which are both numerous and important. For our purpose (and including in this those of more strictly chemical interest) they may be divided into two classes:—

1. The rarer minerals, consisting of ores containing antimony, bismuth, cobalt, gold, tungsten, uranium, and mercury (?).

2. The commonly occurring minerals, consisting of ores containing arsenic, sulphur, copper, iron, lead, silver, manganese, tin, zinc, barium, and the mineral kaolin.

1. Of the rarer minerals, antimony occurs in several parts of Devon, but only to a very limited extent. Antimonite is found near Bovey Tracey. It was worked for a short time, but the venture was not financially successful. Bismuth ores are occasionally met with, not in sufficient quantity, however, to become marketable.

Cobalt occurs sparingly in several localities. The largest yield on record from one mine occurred in 1820, when, according to Worth, "1700 lbs. of ore of inferior quality were raised and sold from Wheal Huckworthy, near Sampford Spinney."

Native gold occurs, too, but in small quantities. It has been found in the beds of the Dartmoor streams, and also by Mr. Flaxman in the hæmatite of North Molton. The working of this hæmatite for gold turned out a financial failure.

Tungsten, in the form of wolfram or tungstate of iron and manganese, is occasionally met with in tin mines, accompanying the tin oxide, and owing to its high specific gravity greatly impedes the operations connected with ordinary tin dressing. Uranium, as pitchblende, has been found near Tavistock in very small quantities only, not sufficient to become a marketable production.

I do not think mercury can rightly be considered as a Devonshire metal. A few years ago some excitement was caused by the announcement in the local papers that mercury had been discovered in the rocks near Exeter. I was sufficiently fortunate to obtain a sample, which was undoubtedly metallic mercury. It seems, however, to have been thrown there; and I am afraid the whole thing was a hoax.

2. Of the commonly occurring minerals. Arsenic is found abundantly in many parts of the county, as arsenical pyrites, or arsenical mundic, or mispickel—arsenio-sulphide of iron. Until a comparatively recent period, arsenical pyrites was considered valueless, or nearly so; but the great demand for arsenic of late years has vastly stimulated its production. At the present moment, something like

3000 tons of arsenious acid per annum are produced in Devonshire, the Devon Consols Mine alone producing from 150 to 200 tons per month, enough to destroy the lives of perhaps 500 or 600 millions of men. Almost any day there may be seen at this one mine, packed ready for sale, sufficient arsenious acid to destroy every living creature on the face of the earth—a somewhat startling reflection! Of course comparatively little of this arsenious acid is used in medicine. As far as I can make out, large quantities are shipped to the Continent, Germany chiefly, where I believe it is employed in the aniline colour manufactories. The arsenious acid is obtained from the mispickel by roasting the pulverized ore in a reverberatory furnace, with free access of air. The vapours are conducted into long, nearly horizontal zigzag chimneys, in which the arsenious acid is deposited as a grey or black powder. It is removed from time to time, and refined by resublimation. The sulphur which is evolved as sulphurous anhydride, at the same time, is generally allowed to escape into the atmosphere.

Sulphur occurs very abundantly in combination with iron, as iron pyrites or mundic, $Fe S_2$. Mundic is not accounted of much value by the miner, and although it contains about 53 per cent. of sulphur, it is not, so far as I am aware, utilized to any great extent. The little used is employed for the manufacture of sulphuric acid and ferrous sulphate.

Copper.—This metal is found chiefly as sulphide and sometimes as oxide. It occurs very abundantly in some parts of the county. It is worked in the neighbourhood of Tavistock, Buckfastleigh, and North Molton. The ores of copper have, in all probability, been mined from the earliest times, yet it is only during the present century that copper mines have become a really important branch of national industry. Devon Great Consols Mine was, at one time, the most productive and profitable copper mine in Great Britain. On an original outlay of about £1000, the mine is said to have realized in twenty-one years over £1,000,000 sterling in net profits, the Duke of Bedford, as mineral lord, receiving in that period the princely sum of £200,000 in dues. This mine is still working, and although not yielding such profits, is making large returns, especially in arsenious acid. The total production of copper ores varies almost yearly, being greatly influenced by the market value of copper. None of the ores are smelted in Devonshire. They are simply "spalled" or dressed; that is, the gangue or matrix partly removed, and then shipped, chiefly to Swansea, to be smelted.

Iron ores abound in many parts of Devon; the chief are hæmatite, chalybite, limonite, spathic, or carbonate, magnetic oxide, and micaceous iron. Hæmatites are worked near Brixham, Sharkham, and Smallacombe, also at Hennock, and Chudleigh. A brilliant micaceous hæmatite raised at Brixham is ground with linseed oil into a paint, and is largely used for covering iron work; it is commercially known as "Torbay paint," and is used by gas and water companies, and in several government departments. Spathic iron ore is found in the Teign valley. Micaceous ore occurs near Lustleigh; it was formerly, under the name of Devonshire sand, used as a pounce; its chief use now seems to be for mixing with graphite and as a lubricant. Magnetic oxide was worked years ago at Haytor, near Islington, but of late years it has been discontinued. Although Devonshire is comparatively rich in iron, the working of the mines seems to have lacked spirit and enterprise, or in some way to have been discouraged, for the total yield of all the Devon mines in 1874 was but 21,313 tons. Succeeding years have shown a falling off, even from this small yield.

Lead occurs chiefly as sulphide or galena. The Devonshire lead mines have been famous from the most remote times. They are said to have been worked by the Romans. There is a record of their having been worked, more particularly for the silver contained in the lead, in the reign of Edward I., and at that time were accounted profitable. The ancient silver lead mines of Combe Martin were re-opened in the time of Elizabeth, and after yielding enormous profits were again closed, to be within the last few years again re-opened with, it is said, satisfactory results. The Lord Mayor's cup is made of silver extracted from these mines.

Silver.—Native silver is found occasionally, but in small quantities only. The chief source is the argentiferous galena, some of which carries as much as 120 to 140 ounces of silver to the ton. In 1857, 50,000 ounces of silver were produced in the county, since which time the amount seems to have gradually decreased. Very recently a silver lode has been opened up at Wheal Newton, which promises to be exceptionally valuable, some parts of the lode are said to yield as much as 2495 ounces to the ton. A not inconsiderable amount of silver has, of late years, been obtained from a cuprous iron pyrites found in several places in the county. This ore carries from 2 to 4 or even 6 ounces of silver to the ton, as well as from 2 to 3 per cent. of copper. At New Consols Mine ranges of furnaces, lixiviating and precipitating tanks have been erected, and for some time worked to obtain silver and copper. The process followed is an old and simple one. The ore is roasted with about 10 per cent. of salt to convert the metals into chlorides; it is next boiled with solution of salt, in which the silver and other chlorides dissolve. This solution after filtration is passed, whilst hot, into tanks containing scrap iron, which causes a deposition of the copper and silver in a metallic state, known as cement, copper, or silver. The silver is afterwards separated from the copper at the refineries in the usual way. Other processes have been devised, whereby the silver and copper are deposited separately by galvanic agency.

Manganese is mined very largely in Devon. The grey and black oxide are the two ores worked, the latter—the binoxide—is by far the most abundant. It is found chiefly in the district around Milton Abbot. At times the ore is found in very grotesque forms, frequently having the appearance as though it had been fused. The ore undergoes a process of dressing, and is then shipped—chiefly to Glasgow—where it is in pretty constant demand. Devonshire yields by far the greater part of the native manganese of Great Britain.

Tin.—Although there are evidences of very ancient works indicating that tin has been mined from the remotest times, almost in every part of Dartmoor—the only part of the county where tin is found — yet the amount raised is very small as compared with Cornwall. The old stannary towns were Chagford, Ashburton, Tavistock, and Plympton. The three first are noted in a charter, dating about 1305, and the last was constituted in 1328. Up to this period, Devonshire appears to have been the principal tin yielding county, but shortly after this Cornwall took the lead, and still retains it. The only ore of tin raised is the binoxide or cassiterite.

Zinc occurs as blende or black-jack in small quantities, in many mines, but the amount produced in Devon is exceedingly limited, and certainly not of commercial importance.

Barytes occurs as sulphate in several parts of the county. In the Teign valley it has been worked. Its use appears chiefly to be as an adulterant of white lead. The amount raised is comparatively limited.

Kaolin, the last of the minerals I have to notice, is derived from granite, is in fact the insoluble residue of the feldspar of the granite. Kaolin may perhaps not seem to have any very prominent pharmaceutical interest; still there can be no doubt that, as chemists, we are greatly indebted to this material in the matter of crucibles, evaporating dishes, and such like. But over and above this, there is one paramount reason which induces me, in the midst of this gathering of eminent pharmacists, to especially emphasize this simple mineral kaolin, and yet not the kaolin, but the man who, in a generation gone by, discovered in this mineral and the moorstone commonly accompanying it, the material which forms the basis of all true porcelains, and that man was a chemist and druggist, a native of Devon, and a citizen of this very town of Plymouth in which we are now assembled. I cannot do better than give you Worth's * account of this worthy Devonshire pharmacist, by name William Cookworthy. Cookworthy "was born at Kingsbridge, April 12, 1705, and his father, who was a weaver, died when he was a lad, leaving his family in straitened circumstances. Young Cookworthy was apprenticed to a firm of druggists in London named Bevans; and it is stated that, in consequence of want of means, he had to walk to London to enter upon his duties under that firm. He won the esteem of his employers, becoming not only an able man of business, but an accomplished chemist, and by the aid of the firm established a wholesale drug business in Notte Street, Plymouth, at first under the style of Bevans & Cookworthy. With this firm, which, subsequently, on the admission of his brother Phillip as partner, became that of William Cookworthy & Co., Cookworthy remained connected until his death in October, 1780. He was in many respects a remarkable man, and his life is one of the most illustrious examples of men who have risen, of which even England can boast. Emphatically self-made, he had none of the foibles which frequently mark the characters of those who have been the architects of their own fortunes. An industrious man of business, a shrewd and painstaking inventor, deeply versed in the science of the day, valued in society for his geniality and power of conversation, he was at the same time one of the simplest and devoutest of Quakers, and an enthusiastic believer in the views of Swedenborg. He was withal most absent-minded, and on one occasion, while on his way to a meeting at Exeter, was so engaged by a novel which he found on an inn table, that he never reached his destination. Yet he was, in the words of Sarah Champion, an 'eminent minister' in the Society. His benevolence was as abundant as his charity was extensive, and he had 'originality of character,' and 'a lively, entertaining manner.' He was a firm believer in the divining rod, and left a treatise on its uses. In short, Cookworthy was a man of many sides, but always genial, courageous, and persevering; a man who won the respect and esteem alike of high and low by his strict integrity, wide sympathies, and varied powers; one who, having set his hand to the plough, was not ready

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* "Transactions of the Devonshire Association," 1876, vol. viii., page 481.

to turn back. And this was the man who, not by accident, but by patient, well-directed research, prosecuted during his business journeys, first discovered in this kingdom the existence of the china-clay and china-stone—the kaolin and petunste—which are the necessary ingredients of true porcelain; and then, not having, like Wedgwood, been bred a potter, taught himself the potter's art, and by careful study and long-protracted experiments, extending over many years, reproduced in England the hard porcelain of the East, the secrets of whose manufacture he had thus attained, and gave to his country new forms of industry and new sources of wealth."

Since Worth wrote this, a stained-glass window has been placed in the New Plymouth Guildhall, to commemorate not the least one of Devon's worthy sons, and one, who in a sense is connected with ourselves, in that, like us, he was a working pharmacist, but of a generation gone to its rest.

May we, especially those amongst us who claim to be of his county, stimulated by his noble example, seek to emulate the earnestness of spirit which seems to have pervaded his innermost nature, and prove ourselves the worthy successors of this persevering, genial, sympathising, and illustrious Devonshire pharmacist.

The President in proposing a vote of thanks to Mr. Smith, said this paper was a very interesting one, and it was very important in visiting the different parts of the country that the Conference should have such information brought before it as to the materia medica of the different districts.

Mr. Groves asked if the use of the fruit of the *Prunus laurocerasus* as a preserve was at all common in Devon.

Mr. Smith did not think it was general except in one district. He had had jam made from it from the neighbourhood of Bridford, and enjoyed it immensely.

Mr. Ekin said there was a market for any amount of willow bark containing salicin, and he should like to know if any species containing it was found in Devon. Many willows did not contain any, and the one containing most was the *Salix pentandra*, which was properly a northern willow; he did not know whether it had wandered down to the Devonshire moors.

Mr. Cottrell (Shepton Mallet) thought the term "organs," did not come from any of the mints, but from the wild thyme or origanum. The oil of pennyroyal was very much used in Somersetshire amongst the working classes.

Mr. Smith said he had not much experience in willows, but he believed they nearly all grew in Devon. With regard to the word organs, it had been suggested to him before that it was a corruption of origanum.

The next paper read was entitled—

SOME EXPERIENCES IN THE EQUIPMENT AND WORKING OF A SMALL PHARMACEUTICAL LABORATORY.

By G. F. Schacht.

The contrasts that exist between English and continental pharmacy have been a favourite topic with many of our travelled brethren; the lines of comparison have been many and various, and the conclusions arrived at have naturally not always commanded universal consent. But upon one point many of us have agreed in thinking that English pharmacists (taken as a body) were open to a charge that did not so generally lie against their continental neighbours, namely, that they bought too many and made too few of the preparations they consumed.

Critics of the severe order have sometimes followed this charge with the assertion that want of knowledge and want of skill are the true reasons for the phenomenon, and, on the other hand, the defence has not unfrequently been heard, that the question is solely one of economics; and that if premises and profit could but be put out of consideration, a very different order of things would prevail.

The defence, no doubt, sounds mean, and perhaps in an assembly like this ought scarcely to have been whispered; but my own experience (known only to myself) teaches me rather to sympathise with than to criticise the difficulties of those who, out of the workings of a small business, are trying, as a first duty, to pay twenty shillings in the pound; and consequently I am disposed to even applaud the defence.

Nevertheless I urge two points—1stly, an expenditure is not in every case an extravagance; and 2ndly, a very hopeful economy for pharmacists to practise is the economy of their overtaxed energies. And from these follows the deduction, that it cannot be otherwise than wise to sustain and refresh those energies by all available methods, and especially by such as will enable them in the fulfilment of daily duties to labour with the best and therefore most profitable result.

Upon such a subject one must be careful not to dogmatize; nevertheless every man's experience ought to be of some value, and I therefore beg to offer such as I can give.

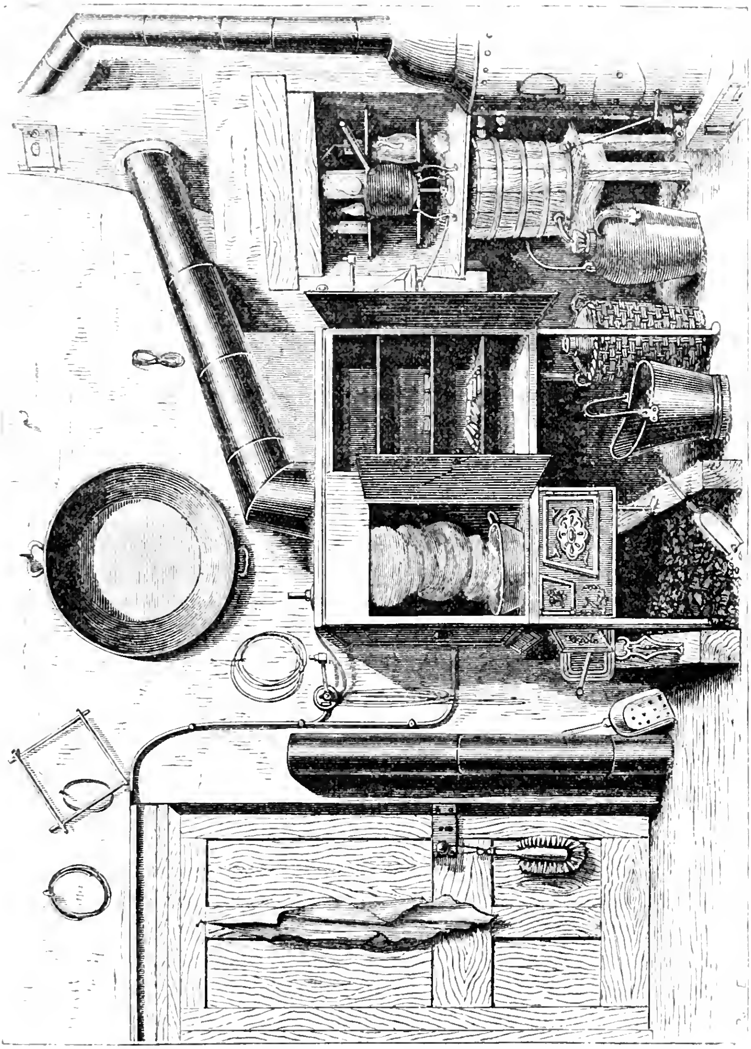
I long since came to the conclusion that it was best to make as many of the preparations we consumed as possible; and also that it was best to conduct operations of manufacture away from the interruptions of the shop. Several attempts to adapt one's premises to these ideas have been made at various times, and with certain measures of success; the latest I shall try and explain to you. Perfection is not for one moment thought to have been reached, still I find myself working with more satisfaction than hitherto. And here it is my duty and pleasure to remind you of a communication forwarded to the Journal by Mr. Corder, of Norwich, and published in October of last year. It is thoroughly worth attention, and would perhaps have been of still greater practical value had fuller references been made to the cost of the several portions of apparatus there figured, the spaces they actually occupy in his laboratory, and the expense of some of the more frequent operations they assist to perform. But I feel personally grateful to Mr. Corder for his paper, and willingly acknowledge that, as far as this communication is concerned, I am following his lead.

The size of our firm's laboratory is 10½ feet by 13 feet, and it is 10 feet high. Its erection absorbed the last available bit of our back yard. We would gladly have extended its area a few feet had that been possible, but, space being peremptorily limited, our only course was to try and turn such as we had to the best account.

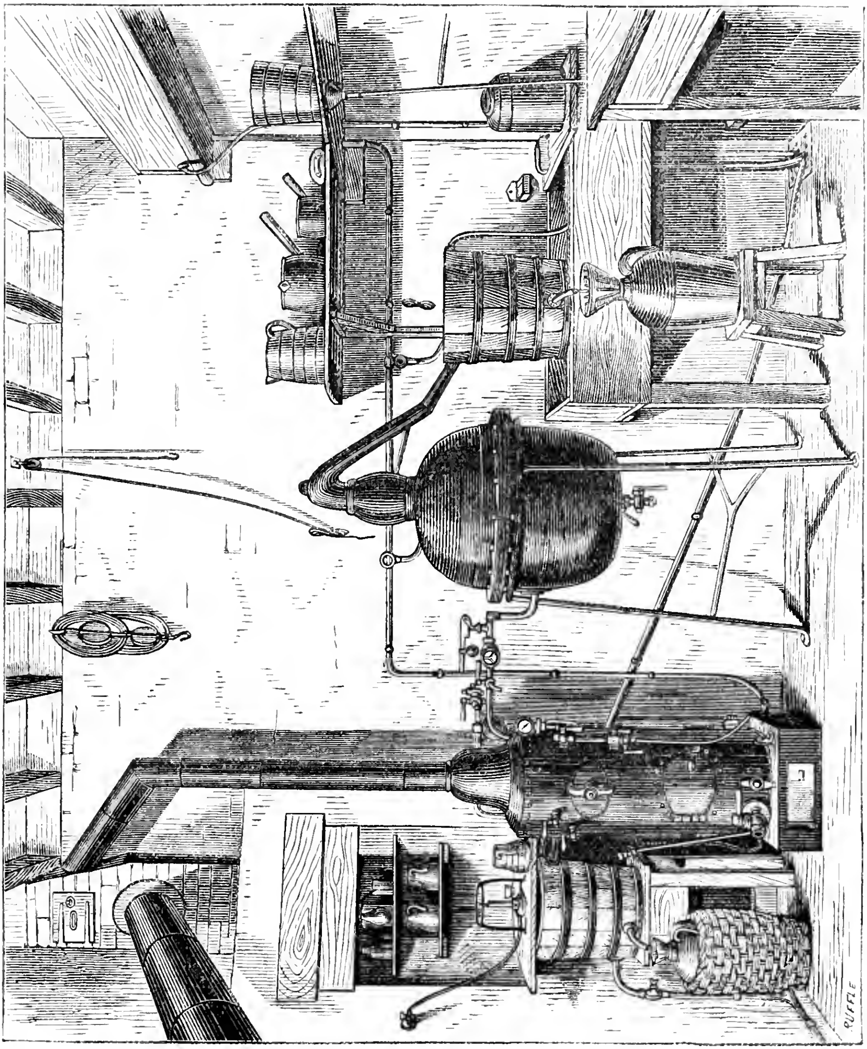
Light being fortunately obtainable from the roof, the whole of the wall space, with the exception of 2½ feet by 7 for the door, became available for fittings.

These four drawings, executed by the clever and willing hand of my pupil, Mr. John Tatham Thompson, represent the aspect of the four walls.

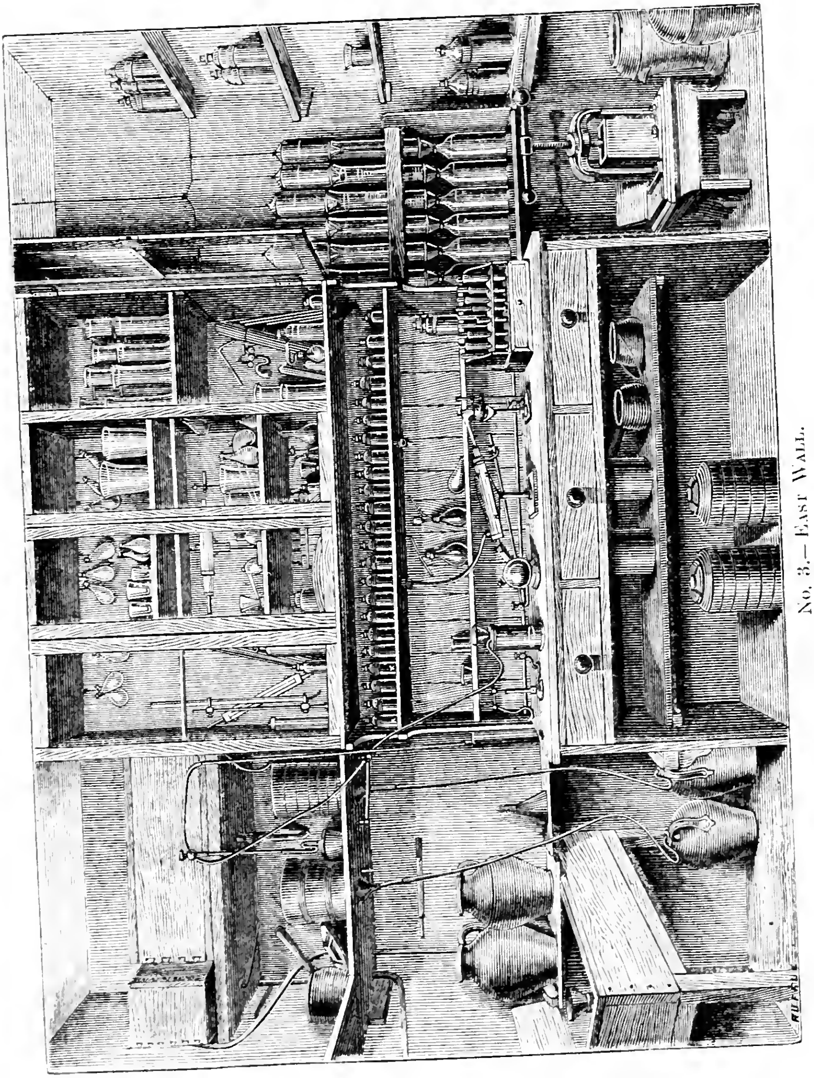
No. 1 represents the west wall, through which we enter by the door on the left. It is almost entirely occupied by a stove and drying closet. The former is 16 inches wide, 20 long, and 12 deep, and is enclosed by a portion of the square hood of zinc, the other part of which constitutes the drying-closet. The latter is divided by a diaphragm of zinc from the portion immediately over the stove, but the flue of the stove passes just within the diaphragm, and serves to keep the closet at a good drying temperature. It is supplied with four trays, each measuring 20 inches square. The flue inclines from the top of the hood to the main chimney in the corner; a large



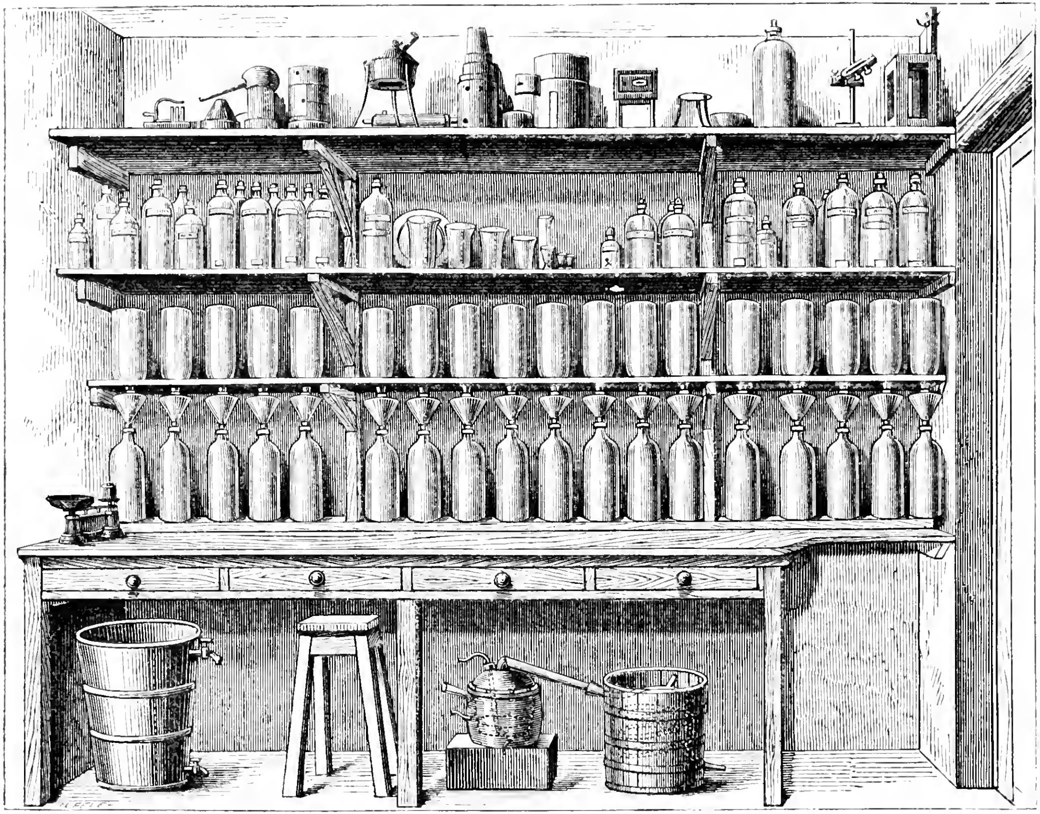
No. 1.—North-west Wall.



No. 2.—North Wall.



No. 3.—East Wall.



No. 4.—South Wall.

outer pipe accompanies it, and serves to convey to the chimney any steam or vapour that may be produced either in the stove chamber or the drying-closet, the heat produced by the flue, which passes through its centre, causing a good draught.

The large pipe at the side of the door is a ventilating shaft, and the space immediately under the stove is for fuel. A small desk for the laboratory book and the diary stands against the wall to the right of the closet.

In No. 2 (north wall) we see the main chimney, beneath which and communicating with which is the fume-chamber. This, for the sake of getting a little greater depth, is placed diagonally to the two walls, and measures about 2½ feet in height and width, and is 1½ foot deep. Its floor and two shelves are of slate, and the walls are cemented. Beneath this is a worm-tub, diameter 16 inches, height 15 inches, for the condensation of superfluous steam. The boiler of iron is immediately to the right, its diameter is 15 inches, and its height 3½ feet. It holds about 8 gallons, and is filled by a pipe connected with the main. It is equipped with the usual appurtenances, fire-box, safety-valve, pressure-gauge, etc., and is supposed to be equal to a pressure of 100 lbs. to the inch and more. The steam pipe passing off to the right is supplied with sundry cocks. When all these are closed, and the fire duly burning, the pressure within of course accumulates. If the cock at the back be opened, the steam escapes through the worm-tub already mentioned, and is condensed into distilled water. If that furthest from the boiler be opened, the steam passes into the jacketed apparatus which stands next. This consists of an enamelled iron pan or basin of 10 gallons' capacity, jacketed with iron, all of sufficient strength to withstand an internal pressure of 30 lbs. or 40 lbs. to the inch. Its outside measurement, exclusive of a 3-inch rim, is diameter 22 inches, depth 22½, and it is held in its required position by an iron tripod. The jacket is provided with a safety valve that blows off at about 20 lbs. pressure, and at the bottom a pipe and stopcock communicates through the jacket to the pan, through which the contents may be drawn off.

This pan or basin in converted into a still by lowering upon its rim the head and securing the joint with a little luting; the swan-necked extremity of the head passes into a condenser temporarily placed over the sink; the arrangement is convenient for the recovery of spirit, etc.

It will be noticed that the steam pipe is further provided with two cocks opening to the front. From these by means of good elastic tubing steam of moderate pressure can be conveyed to any separate piece of apparatus, as we shall presently see.

On the extreme right is a sink, 3 feet 6 inches by 2 feet. The water is introduced to the laboratory near the floor upon the west wall, and passes along the north wall over the sink to a small reservoir near the top of the east wall, and the pipe is supplied with taps at convenient spots.

No. 3 is the east side, and is mainly occupied with a deal counter, some drawers and shelves enclosed in glass. A gas-pipe with two taps runs along the back edge of the counter, and a water-pipe, also with two taps, from the reservoir is conveyed along the front of the second shelf. Further, a waste-pipe, also provided with two taps, passes along the wall and inclines downwards as it approaches the sink on the left. A Liebig condenser or any similar piece of apparatus can thus be kept in continuous and cleanly operation.

By the side of the rack of shelves on the left is placed one of Mr. Fletcher's arrangements for producing an air-blast for blowpipe; it can also be applied as an aspirator. Still further to the left, and in part over the sink, are placed two of my own filters, holding two gallons each, for which we have very nearly constant employment.

On the right of the shelves is a rack for six displacement tubes with their accompanying receivers and reservoirs, and beneath them is a small press.

Along the south wall, No. 4, runs a counter and a series of shelves; they are fitted for purposes somewhat special, perhaps, to our own particular business, and might be replaced by anything thought to be more required.

Among the appliances here stowed away till required is the one employed in the preparation of distilled medicated waters. For this the two spare steam-taps already mentioned have to be employed. The ingredients are placed upon a colander within the small still, the body of which is immersed into a vessel that acts as a jacket to it. Steam is now introduced into this jacket, and when the whole is well heated to boiling point, the other tap is turned, and steam is passed into the still below the colander. It there traverses the ingredients and passes out for condensation in the usual way, carrying with it the volatile constituents of the ingredients. I think distilled waters made by this method are more delicate in flavour than if prepared by any other plan. The size of this apparatus is only that of a large saucepan, but it is sufficient for the preparation of one gallon of cinnamon or other pharmacopœial water.

One piece of apparatus more finds room in this large laboratory—it is a grinding-mill. The wall space being all absorbed, a stout stand was made for it, and when not in use for holding this mill it is covered with a top and converted into a table. It stands in the centre of the laboratory.

The large stone and iron mortars are in an adjoining wareroom, and are brought in when required.

I may further state that the floor of the laboratory is of Portland cement, the walls of brick faced with cement, and the roof is of open rafters boarded and covered with zinc. The roof contains a fanlight four feet square, capable of being opened at both sides for ventilation.

Now with regard to the cost. I find the building cost £48; the carpenters', plumbers', and gasfitters' work for the internal fitting amounted to £37; the boiler cost £20; the jacketed pan-head and worm-tub, £19; the worm-tub under the fume chamber, £4; the stove and drying closet, £8; the mill, 50*s.*; the apparatus for distilling medicated waters, £2 17*s.*; the blow-pipe and accessories, £1: sundry fittings, £7; making a total of £150.

The expense of working is very small. I burn nothing but coke in either the boiler or the stove, and I can keep them both going for a whole day with a consumption of less than a half hundredweight of coke, which in my neighbourhood means about 5*d.* worth of fuel.

Thus at a cost for fire of 3*d.* I can supply 16 gallons of distilled water, or supposing other wants to be more urgent, I can for the same amount draw, say, 1 gallon of cinnamon water, 1 gallon of dill water, make a batch of 50lbs. of syrup, and still have 3 or 4 gallons of distilled water as a by-product.

To the many other purposes to which these appliances can be turned I cannot now refer, but I am sure they offer opportunities for doing many things with great convenience and as well as the intelligence of the operator chooses.

I hope all who see and hear this communication will be good enough to remember that it is addressed only to the average pharmacist. The "traditional houses" have long since supplied themselves with all that is good, and have not allowed the thought of cost to enter into the question. They are far past the necessity of any hint from me. But every house now "traditional" had its beginning, and my chief purpose is to show at how little risk this early step in progress may be made.

The PRESIDENT, in thanking Mr. Schacht for his paper, said the fitting up a laboratory was something like ventilating a room—the means must be adapted to the circumstances of the case. Mr. Schacht had to put up his building first, but very often those who had to fit up a laboratory had a building ready to hand which they had to utilize in the best way they could. His own opinion was that it was not desirable to attempt too much the *multum in parvo*, but rather to confine one's self to a few simple pieces of apparatus, unless there was abundance of space.

A vote of thanks was passed to Mr. Schacht and to Mr. Thompson, who had so beautifully illustrated the paper.

Dr. ROWE (Redruth) agreed with the remarks of the President, and expressed the satisfaction he had received at listening to Mr. Schacht's paper.

Mr. MOORE asked if the purity of the water distilled in the simple apparatus described by Mr. Schacht was sufficient for all practical purposes.

Mr. GREENISH said it had been his privilege to see laboratories in many parts of Germany, Austria, St. Petersburg, and Moscow; in fact, a laboratory was almost universally found in those countries, even in establishments of the smallest size. It was formerly required by law in Germany that every pharmacist should have a laboratory. Latterly this rule had been relaxed, but the pharmacist was still held responsible for each article he sent out, just as if he had made it himself. With regard to apparatus, his own was very similar to that described by Mr. Schacht. He thought, however, there was the disadvantage in a drying cupboard, such as Mr. Schacht described, that if the stove or fire was not always in operation, the drying process went on irregularly. Distilled water was always a difficulty with pharmacists, and he never could get any kind of apparatus which would give him the quantity he required until he made an arrangement in connection with his kitchen boiler, by means of which he now had more than he could use. He had a close range in the kitchen with a wrought iron boiler from which a 1½ inch pipe passed upwards and on to the chimney piece, where it was divided into two ¾ inch iron pipes; one passed into the area, and had a valve upon it, and the other into the laboratory, where it terminated in a large coil of block tin, placed in a tank of galvanised iron to form a condenser. He had had this in use for some time, and it answered admirably.

Professor ATTFIELD said there was a sectional sketch of a distilling apparatus, connected with the kitchen boiler in the *Year-Book* for

1871, p. 604, in illustration of a paper by Mr. Staples. Mr. Bottle stated at the meeting at which that paper was read, that the plan was an old one, and that he had had a similar apparatus in use for twenty-five years.

Mr. CHIPPERFIELD remarked that such an arrangement was not compatible with a continuous supply of hot water to a bath, such as he had attached to his kitchen boiler.

Mr. GREENISH said in such case it would be necessary to have two boilers.

Mr. CHIPPERFIELD added that a very good drying closet could be made by passing the hot water pipe supplying the bath through a cupboard, forming the pipe into a coil at the bottom before it passed up to the bath.

Mr. SIEBOLD remarked that German pharmacists had in course of time found that it was by no means wise to make a great number of preparations on their own premises, and that in many instances it was better to purchase them from wholesale houses who made them on a large scale. When he was an assistant in German pharmacies he made many preparations which he was sure were not made there now, because it was much more expensive than buying them ready made. Laboratories were still found, but the number of preparations made was comparatively small, being chiefly confined to those articles the purity of which it was difficult to ascertain by testing; such, for instance, as the extracts, tinctures, and other preparations of a purely pharmaceutical nature. With regard to chemicals, the existence of the smallest percentage of impurity could be readily detected, and there was therefore no inducement to make them.

Dr. SYMES thought that as a matter of economy no pharmacist would ever attempt to make all his own preparations, because where these things were made on a large scale it paid persons of skill and experience to devote their whole attention to the operation, and thus better results were insured than could be obtained in a small laboratory with divided attention. There was, however, another side to the question. He had noted for many years the want of original research amongst English pharmacists, and the complaints made by the editors of the Journal that they had to go to a foreign source in order to present their readers with those interesting practical papers which all read with so much pleasure. So long as pharmacists confined their attention to examining the things they bought (which would often take almost as long as making them), they would never get a variety of experience brought to bear on the manufacture of many preparations, and this was what was required in order to effect any improvement. One man would try one thing, and another another, and though the results might appear contradictory, if they were all willing to learn the experiments would lead to improvements which would perhaps never be made if they looked at the matter merely from a pecuniary point of view.

Dr. PAUL described a form of still which he considered superior to that shown by Mr. Schacht, inasmuch as the head could be fixed without luting. The body and cover were provided with accurately turned flanges, and by means of screw bolts a perfect joint could be made. At the bottom, in place of a cock which was always getting out of order, he had a conical hole fitted with a plug, on raising which the contents escaped. He also described and sketched a horizontal mill which was self-cleansing, the material ground in it falling down by the action of gravitation.

Mr. GROVES said that he employed an iron boiler with iron pipes for distilling water, but he found the result unsatisfactory, because some of the steam got condensed in the iron pipe and carried down impurities, but he got over that difficulty by passing the steam into a tin vessel something like a Wolff's bottle before it was admitted to the condenser. Still he found a large quantity of ammonia in his distilled water, which was probably owing to the water used containing nitrates which were reduced by the iron of the boiler.

Professor ATTFIELD drew the attention of the Conference in connection with this subject to the patent process of Professor Barff for coating iron with black oxide, which so marvellously resisted the action of many substances that affected ordinary iron. He was quite sure this new material would come largely into use in pharmacy, as it would in many industries, and he hoped before the next Conference some gentlemen would be able to give the Conference practical information on the subject.

Mr. COLES (Chippenham) said that if a small laboratory was not always a financial success, it must give opportunities for research which no mere testing of chemicals would do, and would be of immense advantage to young men learning the business.

Mr. GREENISH said there was a very excellent American mill now imported into this country at a very moderate price, which was specially useful where percolation was employed to any extent.

Mr. SCHACHT said he had derived much satisfaction and instruction from the discussion which had taken place, and had very little to add by way of reply. He used gas sometimes, but generally coke, because it was cheaper. His distilled water was perfectly pure, and though he would not say there was never any trace of ammonia, he did not think it existed to any extent. The boiler was of iron, the pipes leading from it were of lead, and it was necessary in putting up a new apparatus to work it for some time before using the product, in order to get rid of the oily matters used in fastening the joints. Dr. Paul's suggestions were very valuable, but it struck him that his arrangement for fitting the still head would be more applicable to a small than to a larger one; the difficulty would increase in proportion as the size increased. There was no question that Dr. Paul's mill was superior to his own, but he had found on inquiry that it would be more than six times as expensive. In conclusion, he should be happy to show his laboratory to any one who happened to be in his neighbourhood.

Mr. Umney thought lead pipes very objectionable where either steam or condensed steam (pure water) was passing through them.

The next paper was a—

NOTE ON DIPHENYLAMINE AS A TEST FOR NITRIC AND NITROUS ACIDS.

By N. H. Martin.

Attention having recently been called to diphenylamine as a test for nitric and nitrous acids, it has appeared to me the subject might not unworthily occupy the time of the Conference for a few minutes. The tests for nitric and nitrous acids, both free and in combination, at present in general use, are just so far unsatisfactory as to render welcome the addition of any reagent to the resources of the analyst, the more so when the proposed reagent is one easily applied and of considerable delicacy. This substance, in common with so many other aniline derivatives, has ceased to be a mere chemical curiosity, and being manufactured on a commercial scale there is nothing to prevent its finding its way into general laboratory use.

Diphenylamine, $C_{12}H_{11}N = NH(C_6H_5)_2$, is a "base produced by the action of various phenol compounds on aniline, the reaction consisting in the substitution of phenyl (C_6H_5) derived from the phenolic ether (C_6H_5OH) for an atom of hydrogen in the aniline ($N(C_6H_5)H_2$) molecule." This may be done in various ways —for instance, by heating aniline hydrochloride with phenol and fuming hydrochloric acid; but it may be that none of the published processes are actually followed when this is manufactured on a commercial scale. Several of the aniline compounds have delicate reactions with various acids, but I only find that one of them has been used as a test for nitric acid, and that is the sulphate. A note on this subject will be found at page 164 of the *Year-Book* for 1870, but the author from whom it is quoted is not mentioned. The fact is simply recorded that sulphate of aniline is stated to be a "surprisingly delicate test for nitric acid." In a paper "On the Estimation of Nitrous and Nitric Acid," read before the Newcastle-on-Tyne Chemical Society, by its late President Dr. Lunge (now at Zurich), and copied from the proceedings of that society into the *Pharmaceutical Journal* of Aug. 11th, 1877, it is stated that diphenylamine "is the most delicate of all reagents for ascertaining the freedom of sulphuric acid from nitrogen compounds." Dr. Lunge's remark has led me to try several experiments upon a number of samples of so-called pure sulphuric acid, and of these one only failed to give distinct indication of the presence of nitrogen compounds in greater or less quantity. I do not propose to enter upon the theory of the reaction or to occupy your time further than is necessary to explain and show the application of the test.

The method of using the test is as follows:—Take a small quantity (about the size of a mustard seed will do) of the diphenylamine, put it into a test tube, and pour a little sulphuric acid over it, then add a drop or two of water so as to increase the temperature sufficiently to effect the solution of the diphenylamine, and the test is ready for use. Now add very gently the solution to be tested, and if only a trace of nitric or nitrous acid be present, a beautiful and very permanent blue coloration is produced at the junction of the two liquids; but if there be any quantity of the nitrogen compound, the colour becomes almost black. This reaction is so delicate and certain that in the case of a solution of nitric acid containing about one part B. P. acid in 10,000 of water the reaction is most distinct. one part of nitrite of potassium in 30,000 of water gives also most unmistakable evidence of the presence of the nitrogen acid.

The value of this test seems to me to consist in its being so readily used and in its indications being so quick and well defined. I have spoken only of diphenylamine being used as a qualitative test, but it will also make a very fair quantitative test, by comparing the coloration produced respectively by a given quantity of the acid to be tested and a given quantity of acid containing a known quantity of nitrous acid, with an excess of the reagent.

I have not been able to make out to whom we owe the first suggestion of the utilization of this reaction, but I take the chance of its being as new to many of the Conference as it was to myself.

A vote of thanks was passed to Mr. Martin for his paper.

Mr. ALLEN said he understood that Mr. Martin proposed to compare the colour with that furnished by a known quantity of nitrous acid. If the process answered for nitrates as well as nitrites, would it not be more convenient to use nitre in solution?

Mr. MARTIN said the process would certainly answer as well for nitrates as for nitrites.

The next paper read was entitled,—

THE PILL MASSES OF THE B. P. WHICH ARE OF AN INCONVENIENT CONSISTENCE, OR ACQUIRE THAT CONDITION BY KEEPING.

By JOHN C. THRESH.

This paper is an answer to query No. 36 in the list of subjects for research issued by the British Pharmaceutical Conference in May, 1877.

Of the twenty official pill masses the seven following have, or acquire by keeping, a consistence unsuitable for dispensing:—

Pil. Aloes et Assafœtidæ.
,, Aloes et Ferri.
,, Aloes et Myrrhæ.
,, Cambogiæ Co.
,, Coloc. Co.
,, Ferri Carbonatis.
,, Phosphori.

Of these the pil. aloes et assaf. is too soft, simply because too large a quantity of excipient is ordered. Increase the soap to 1½ oz. and take ½ oz. conserve instead of 1 oz., and a good mass is formed corresponding to the B. P. form in strength. Pil. phosph., though perhaps in some respects objectionable, appears to be as good a form as has yet been proposed, and as I doubt whether I can improve it, it must needs be passed over. The other five masses all become hard by keeping, and it appeared likely that some excipients might be found adapted to all. The combination of glycerin and tragacanth is probably the best excipient for the purpose, but no single form for this mucilage is suitable for all the five masses. The pill of carbonate of iron, and the pill of aloes and iron, must be made with tragacanth and glycerin only, and not by Mr. Proctor's form (which contains water), as with the latter excipient they soon become hard. The following forms answer admirably, and the pills thus made will keep for a considerable length of time almost unchanged.

Pil. Aloes et Ferri.

Aloes Bbd., in powder	2 ozs.	
Sulphate of Iron	$1\frac{1}{2}$ oz.	
Comp. Pd. Cinnamon	3 ozs.	
Powd. Tragacanth	1 dr.	
Glycerin	1 fl. oz.	Mix.

Aloes, 1 in 4 nearly. Iron, 1 in 5.

Pil. Ferri Carb.

Saccharated Carbonate of Iron	$6\frac{1}{2}$ ozs.	
Powd. Tragacanth	$1\frac{1}{2}$ dr.	
Glycerin	$1\frac{1}{4}$ fl. oz.	Mix.

The three remaining pills are best made with Mr. Proctor's excipient.

Tragacanth powder	3 drs.
Glycerin	9 fl. drs.
Water	4 fl. drs.

Mix the gum and glycerin till smooth before adding the water.

The specimens sent have been made nearly a year, are in excellent condition, and so far as I can tell, as active as the freshly prepared masses. As pills made with this excipient are with difficulty disintegrated by action of water, it has been asked whether they are as active as those made with the B. P. excipients. To satisfy myself upon this point, I have had administered purgative pills of both kinds, and I have failed to detect any appreciable difference in their action upon the bowels. (I could not say, however, that pills of opium, morphia, etc., act as speedily when made with tragacanth.)

For pil. coloc. co., use 1 oz. of mucilage instead of the water. In pil. cambogiæ co., 1 part of excipient may replace the syrup. Pil. aloes et myrrhæ requires a rather larger proportion of excipient, otherwise it becomes very tough. A good form is—

Powd. Soc. Aloes	2 ozs.
,, Myrrh	1 oz.
,, Saffron	$\frac{1}{2}$ oz.
Glyc. Tragacanth	1 oz.

If it should be deemed necessary to make the form correspond in strength to the B. P. pill, $1\frac{1}{4}$ oz. of some simple powder, as pulv. cinnam. co., might be added, and the $1\frac{1}{4}$ oz. of excipient would then reduce it to the desired strength.

The PRESIDENT said it was very desirable to ascertain the best method of producing these pill masses so as to keep for a reasonable time without becoming unduly hard.

Mr. GREENISH said Mr. Thresh appeared to have generally used the excipient introduced by Dr. Symes—tragacanth and glycerin; only he had first put in the tragacanth and added the glycerin afterwards to the mass. Mr. Thresh seemed to think that a pill which became hard from the introduction of tragacanth might perhaps not be readily soluble in the stomach; but when examining tragacanth for the cell tissue and starch in it, he (Mr. Greenish) had been astonished to find how the hardest piece dissolved by the addition of the smallest quantity of moisture, more readily probably than any other gum.

Dr. SYMES, though he had used tragacanth and glycerin for some years for pill masses, could not claim any originality in the matter. He must take exception to the remark that the pil. phosphori of the B. P. was the best form that could be used, for he considered it one of the worst. He had heard from medical men and read that this pill passed through the system without being disintegrated.

The PRESIDENT said, though he agreed with Dr. Symes' remark as to pil. phosphori, if used in the form given in the Pharmacopœia, he could not in any other sense do so at all. On the contrary, he considered that form to be unobjectionable, and in many respects an excellent one. He had stated over and over again that the pil. phosphori was not intended to be administered in the form in which it stood, but should be mixed with soap. The reason why soap was not introduced into the formula was that if the pill mass contained soap, it could not be kept immersed in water, whereas in its present form the phosphorus might be kept ready for use for an unlimited time unoxidized. It was intended to be kept beneath the surface of the water, and might be so kept for any length of time. Mr. Ekin had suggested that the balsam of tolu might be replaced by hydrated resin, which also might be incorporated with the phosphorus under the surface of water. The form given in the Pharmacopœia originated with Mr. Abraham, of Liverpool, and the balsam of tolu was selected because its specific gravity enabled it to be kept in a melted state in hot water, and the phosphorus could then be completely incorporated with it without any exposure to the air or any chance of oxidation.

Dr. SYMES thought it was a great misfortune that medical men had not been officially informed how this pill should be administered. He grounded his remarks on what he had heard and on letters which appeared constantly in the medical papers, pointing out that the pil. phosphori would occur in the fæces entirely unaltered.

The PRESIDENT said it would be no doubt an advantage if an addition were made to the formula, saying that soap should be mixed with the pill mass when administered.

Mr. GERRARD said he had had considerable experience in the making of phosphorus pills, and although he was the author of the suggestion that phosphorus was soluble in resin, he now thought the best way was to use that solvent *par excellence*, bisulphide of carbon. The great difficulty in every case was to prevent oxidation, but he had recently adopted the following method to meet this difficulty :—Immediately the least trace of oxidation was perceived after the evaporation of the bisulphide of carbon, he added a little chloroform, which, being a heavy vapour, prevented contact with the oxygen of the air. While the materials forming the pill were surrounded by chloroform, water could be added and the pill mixed up with the loss of hardly any phosphorus by oxidation.

Thanks were voted to Mr. Thresh for his paper.

The next paper read was—

SOME FURTHER EXPERIMENTS UPON THE ALOINS.

By WILLIAM A. TILDEN, D.Sc., LOND.

When nataloin is digested with a 10 per cent. solution of bichromate of potassium, acidified with the proper quantity of sulphuric acid, brisk effervescence occurs owing to the escape of carbonic acid gas; but an examination of the liquid led to the discovery of nothing else except acetic acid. In a former paper I pointed out that when nataloin is treated with nitric acid it yields carbonic and oxalic acids and a small quantity of picric acid. I have little doubt, therefore, that when chromic acid is the oxidizing agent employed, a small quantity of some benzine derivative, probably quinone, is formed, but in quantity too small to allow of its ready detection.

Barbaloin and socaloin, as I have already shown in a paper communicated to the Conference, have the same composition, and both yield chrysammic acid as the characteristic product of the prolonged action of nitric acid. When oxidized by bichromate solution, they both behave in precisely the same way, yielding carbonic acid, a little acetic acid, and a yellow compound which, as it has proved rather interesting, I propose to describe.

Whether obtained from barbaloin or socaloin, or even by the oxidation of Zanzibar aloes, this compound has the same properties and composition. In allusion to its yellow colour, I call it "Aloxanthin." It is almost insoluble in acidulated water, but slightly soluble in the ordinary solvents, and is crystallizable with great difficulty.

After purification by repeated deposition from alcohol, acetic ether, or glacial acetic acid, it was analysed, and gave numbers agreeing with the requirements of the formula $C_{15}H_{10}O_6$. When heated with zinc dust this substance is reduced to a hydrocarbon, which turned out to be methylanthracene. The formula $C_{15}H_{10}O_6$ may therefore be written $C_{14}H_3(CH_3)(OH)_4O_2$, which represents a methyltetraoxyanthraquinone. It is interesting to observe that this formula belongs to a third term in the series, to which also belong chrysophanic acid and emodin, two yellow substances existing ready formed in rhubarb root and in the roots of various other plants allied to rhubarb. The relation between these compounds is manifest on comparing their formulæ, according to which they appear as di-, tri-, and tetra-oxyderivatives of methylanthraquinone.

Chrysophanic Acid.

$$C_{15}H_{10}O_4 = C_{14}H_5\left\{\begin{array}{l} CH_3 \\ (OH)_2 \\ O_2 \end{array}\right.$$

Emodin.

$$C_{15}H_{10}O_5 = C_{14}H_4\left\{\begin{array}{l} CH_3 \\ (OH)_3 \\ O_2 \end{array}\right.$$

Aloxanthin.

$$C_{15}H_{10}O_6 = C_{14}H_3\left\{\begin{array}{l} CH_3 \\ (OH)_4 \\ O_2 \end{array}\right.$$

Aloxanthin agrees with chrysophanic acid and with emodin in yielding a cherry red solution in alkalies. It may be sublimed, though the greater part is charred and destroyed in the operation. When treated with cold strong nitric acid, it yields a yellow nitro-compound which has all the characters of the aloetic acid described originally by Schunck in 1841, and which is formed together with chrysammic acid by the action of nitric acid upon aloes. Aloxanthin is also converted into chrysammic acid by boiling for some time with nitric acid.

A vote of thanks was passed to Dr. Tilden.

The PRESIDENT said the next paper was by Mr. Atkins, which would be read, but no discussion would take place upon it, as agreed yesterday.

Mr. GUYER (Torquay) asked if this was to be made a precedent. If so, he should protest against its being read at all.

The PRESIDENT thought the decision deliberately come to on the previous day without any opposition could hardly be disturbed then.

The following paper was then read by Mr. Atkins, and the thanks of the Conference were voted to him:—

A POINT IN PHARMACEUTICAL ETHICS.

BY S. R. ATKINS.

The advantages of such annual gatherings as the present one are manifold: not simply to post the day-book into the *Year-Book of Pharmacy* and scientific research—registering the achievements of the past, possibly initiating new ones; but also enabling us more calmly and judicially to examine and review our ethical relations, home and foreign.

I have thought that it might be expedient at this Conference to refer to one of those questions now engaging the attention of pharmacists throughout the country, viz., their relation to the medical profession.

Confessedly we are in a state of transition; the old is giving way to the new. In this respect we are only sharing the experience of society generally; but from a variety of causes, which a careful analysis enables us approximately to estimate, we, the pharmacists of to-day, are more especially influenced.

It is as difficult for us who are engaged in the strife and controversy of opinion to calculate the exact momentum and direction of the forces so employed, as it is for the individual soldier to discern which way victory leans, when the field is wide and the combatants are numerous. We have, however, amongst us men of experience and capacity—men tried and true—whose lead we may safely follow; and, at least, let us who may belong to the rank and file evince a discipline and obedience worthy of our position.

But to come to the point. What are the true relations between pharmacy and the medical profession?

It is evident those relations at the present moment are not in a healthy condition. The extreme behaviour of the extreme section of either party has imperilled that respect and confidence which ought to exist between them. That such feelings are restricted to the extreme right and left is probably true; that the vast majority of medical men and chemists are innocent of such mutual antagonism is equally true; that the amount of noise such controversies make is frequently in the inverse ratio to their social and professional importance is equally certain. Still the bare existence of such schools of thought is a scandal, and their practical evolution before stipendaries, and ultimately in courts of appeal, renders it imperative on all moderate and law-obeying subjects to seek to bring about a better understanding.

In this suit, pharmacists are the defendants. If Turks have fought bravely behind their own fortresses, so ought we; our position is impregnable.

We stand charged with counter-prescribing—so runs the indictment. To a certain extent we admit the charge, and plead justification. That there are chemists who are in the habit of encroaching on the function of the medical men, we do not deny; such men never have been and never will be defended by the Council of the Pharmaceutical Society of Great Britain. As every flock is said to contain its black sheep, and every large family its odd member, so are the men of whom we speak the exception and not the rule.

With such practices we have nothing to do. What, however, we are careful to defend, as our just and inalienable right, is that simple and moderate counter practice which has grown up without legal enactment, and, as we believe, contrary to none; but which is so embedded, not simply in the habits, but the very necessities of the people, that a blue book of prohibitions could no more extinguish it than an Act of Parliament could convert every Englishman into a Scotchman, however desirable in the abstract such a conversion might be.

We contend for a custom of long standing, as we find it in the vast majority of respectable well-conducted druggists' shops, the practice of prescribing across the counter for simple ailments. And altogether apart from personal and pecuniary considerations, we contend for this custom in the interests of the public. This is the only line of defence worth maintaining, and it is the one which parliament and our courts of law, our legislative and executive authorities, will ever respect.

If it be asked where the line of demarcation should be drawn, we reply, that it is impossible to draw one, but an honourable man will seek to avoid the very appearance of evil, and if parole, the law of honour, fails, no inquisitorial acts of a medical police will ever succeed.

We assert that the custom we are considering has grown out of public necessity, and not from proffered service on our part. We have not sought but been sought. And this, partly the result of higher education and more efficient training; knowledge winning reputation, confidence, and patronage, an order of natural induction. *Noblesse oblige;* the very position knowledge has thus secured will make its possessor all the more careful not to traverse forbidden lines.

What counsel then may we venture to proffer our brother pharmacists, and also, if it be not deemed impertinent, to professional men, so far as this discussion may reach them. We suggest that there is room for mutual courtesy and forbearance, the avoiding of tall-talk and bluster. We have, by a combination of firmness and conciliation, to convince the public and the profession that all we desire is fair play. In order that we may accomplish this, we must be prepared to invite the most thorough inquiry; there must be no back-parlour consultations, no minor acts of surgery, no semi-professional visits; in short, nothing in excess of that ordinary counter practice the meaning of which we all recognise, however difficult the exact definition of the same may be.

Such rights must be defended with the united strength of the entire body of chemists throughout the kingdom. Time is assuredly on our side. Should a hasty decision adverse to our claims be snatched on *ex parte* evidence, or even on the legal interpretation of a statute that ought long since to have been swept away, such an event will prove no permanent disaster, but only hasten the conclusion we desire. One really good case, well argued before an intelligent jury, must secure a verdict in our favour and definitely settle the question.

Such an arbitrament ought, however, not to be necessary; the House of Commons should anticipate any action of this sort by defining what are our privileges.

The day assuredly will come, when medical men and pharmacists will no longer regard each other as competitors but as fellow-workers, both engaged in the treatment of disease, the one in the preparation the other in the administration of remedies. Nor will the wise physician regard with jealous eye the growing culture of the pharmacist, for through it he works with greater accuracy and success.

We each may have something to surrender; if so, let the concession be mutual, gradual, and complete.

At least let hostilities cease whilst the conditions of an honourable peace are being negotiated.

The next paper was read by Mr. Kingzett:—

PRESENCE OF METALLIC COMPOUNDS IN ALIMENTARY SUBSTANCES.

By B. H. Paul, Ph.D., F.C.S.; and C. T. Kingzett, F.C.S.

1. *Introduction.*—Under the Sale of Food and Drugs Act a number of prosecutions have been instituted during the last few years, having regard to the presence of metallic compounds in articles of food. Meanwhile, the knowledge possessed by either chemists or medical men as to the behaviour of such compounds upon the human system in extremely meagre. There can be no doubt that many mineral substances exercise a prejudicial influence upon health, but the measure and nature of this influence is in most cases an undetermined quantity, while it is probable that owing to popular prejudices a number of harmless substances (considering the quantity taken into the system) are assumed to possess pernicious or poisonous properties.

2. *Preserved Peas and Copper.*—One of the most popular of foods, and one which has been most severely remarked upon, is preserved peas. This article of food is prepared for the most part in France, and in connection with it a very considerable trade has developed. The Paris merchants aver that the peas will not maintain their bright green colour unless a small amount of sulphate of copper be added to them, in which case they keep their colour admirably. The quantity thus added varies between one and two grains of the ordinary blue sulphate to the tin of peas, containing from $9\frac{1}{2}$ to $9\frac{3}{4}$ ounces of peas * and 150 c.c. of liquor. The question of what influence this copper has upon health is one which has been hotly discussed, and widely differing opinions have been expressed by medical men. Ordinarily, however, it has been assumed that the copper is injurious to health, and vendors of preserved peas have often been fined in consequence. This difference of opinions is readily explained by the imperfect acquaintance of those who expressed them with the scientific facts.

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* Weighed after separation and draining from liquor as taken from the tins.

It appeared to us that in order to arrive at a proper knowledge of the physiological influences of the copper contained in preserved peas, it was desirable to determine the following points:—

(*a*) Is the copper in mere admixture with the peas, or is it in actual combination with the albuminous or other constituents?

(*b*) Does it pass into solution under the influences of the digestive processes?

(*c*) Is any part or all of the copper thus introduced into the stomach absorbed, or is it eliminated, and, if so, how?

3. *Presence of Copper in Organic Tissues and Products.*—Before proceeding to describe the experiments we have made relative to these questions, we may take note of the fact that from the time of Margraff, Gahn, and Vauquelin, chemists have been acquainted with the presence of copper in organic tissues and products, and in 1856 and 1857, Odling and Dupré made a number of experiments in which they detected traces of copper in bread, flour, wheat, straw, liver, kidney, blood, flesh, eggs, cheese, etc. Thus they found that 6925 grains of human liver furnished 0·013 grain of cupric oxide; while 6682 grains of sheep's liver gave 0·281 grain CuO; 1830 grains of human kidney gave 0·015 grain $Cu\,O$, while human muscle and blood also furnished traces.

Again, Bergeron and Hôte (*Comptes Rendus*, lxxx., p. 268) have more recently demonstrated the presence of copper in the kidneys and livers of fourteen human bodies.

Brain matter also contains notable quantities of copper, which exists there in actual combination with various principles.*

In view of these facts we deemed it desirable to examine green peas for copper, and accordingly two experiments were made with this object.

4. *Method for Detection of Copper.*—The method pursued throughout this investigation for the detection of copper may be at once stated; it consists in burning the suspected matters with a mixture of pure sodic carbonate and potassic nitrate, causing complete destruction of all organic matter; solution of the fused mass in dilute acid and addition of excess of ammonia and filtration from alumina, phosphates, etc. If copper be present the filtrate exhibits a blue colour, and gives the other reactions of copper (such as the one with potassic ferrocyanide in acetic acid solution). If the fused mass be dissolved in water instead of dilute acid, then,

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* See "Relations of Chemistry to Physiology and Pathology," etc., By C. T. Kingzett. *Pharm. Journ.*, Feb. 26, and March 11, 1876.

when phosphates are present, the copper remains in the insoluble residue, and may be detected in it as above.

5. *Examination of Green Peas for Copper.*—In the one experiment above alluded to, 80 grams of shelled new green peas were examined, and in the other the same quantity to which had been previously added 0·4647 grain $Cu\,S\,O_4$ or 0·6526 grain $Cu\,S\,O_4\,5\,H_2\,O$. The natural peas were found to be absolutely free from copper, while there was no difficulty in determining the presence of copper in the case where it had been added, and as this is less than usually occurs in a tin of preserved peas, there should be of course no difficulty in establishing the presence of copper in such an event.

On a subsequent occasion another quantity of 80 grams of a fresh lot of peas was examined for the presence of copper, also with a negative result.

6. *State of the Copper present in Preserved Peas.*—In this part of the research it was endeavoured to ascertain whether the liquor contained in the tins with the preserved peas holds any copper in solution, or whether it is all in the matter of the peas, and whether during the process of boiling the peas any copper passes into a state of solution. It was determined in two cases that the said liquor was practically free from copper, the merest vestige being found. This was ascertained by evaporating the liquor to dryness, and fusing the residue as already described with the soda mixture.

The water in which the peas were boiled contained also but the merest vestige.

The copper, therefore, present in preserved peas exists in actual combination, and is not removed by the process of cooking. In the two cases mentioned, the quantity present exceeded 1 grain of sulphate of copper to the tin of $9\frac{1}{2}$ or $9\frac{3}{4}$ ounces (about 268 grams).

In the fused mass it exists exclusively in that part insoluble in water.

7. *What becomes of the Copper during Artificial Digestion?*—About 5 ounces of preserved peas of similar nature to those described in preceding paragraph were separated from the liquor, reduced to a pulp, and digested at 40° C. with 300 c.c. of solution containing 1·3566 gram hydrochloric acid and 35 c.c. of a glycerin solution of pig's pepsin (Bullock's preparation), during 40 hours. The undigested portion was then separated by filtration, and the process of artificial digestion repeated upon it under similar conditions during 18 hours. The mass was then again filtered and washed, and the bulky green undigested matter and white skins examined for cop-

per, from which it was found to be now practically free. The whole of the copper had passed into solution, about equal quantities being present in the two digestive extracts.

It may therefore be presumed that in stomachic digestion, preserved peas give up their copper to solution; but the extent, probably depends upon the acidity of the gastric juice, the activity of the pepsine ferments, and the time during which the process of gastric digestion is carried on.

8. *Is the Copper introduced into the Stomach absorbed, or what becomes of it?*—On the 13th July, the authors of this paper took each a dose of 0·3 grain $CuSO_4 5H_2O$, and examined the urine eliminated during the next forty-eight hours; it was found to be entirely free from copper.

On the 27th July, and six following days, we each took again daily, 0·3 grain of cupric sulphate, and examined the total urine for the presence of copper; none but the merest trace was eliminated through this channel.

The fæces secreted on the 30th by one of us was examined, and was found to yield abundant evidence of copper, forming indeed a very considerable proportion of a dose.

Therefore, even if a part of the copper be absorbed into the system, another, and probably the greater part, passes out with the fæces. This corresponds with what is known of the action of ferric and mercurial preparations when taken into the system; a part appears to be absorbed, and locates itself at least temporarily in the organs of the body, while another passes out with the fæces, colouring them in the one case black, and in the other case green.

9. *General Considerations and Conclusions.*—Inasmuch as copper is nominally present in certain organs of the body, as stated above, it must get there in the first place through an introduction into the stomach. How, then, can we reconcile this fact with the partial secretion at least of copper with the fæces? Apparently this is very easy of explanation. After gastric digestion, and while the contents of the stomach are still acid, a part of the chyme is absorbed into the blood system, and this would seem to constitute the stage at which the copper is absorbed. The greater part, however, of the digested mass passes on through the pylorus, and undergoes a further change in the duodenum, where alkaline biliary fluid takes part in the process. The probable result as regards the copper would be its precipitation as phosphate, which would not be changed in the intestines, but would be passed as such with the fæces.

Now, if it be considered that ordinarily one person consumes only about two ounces of preserved peas at a meal, and that this quantity would contain only a fraction of a grain of cupric sulphate; and if it be further considered that only another fraction of this amount is ultimately absorbed into the blood system, it is impossible to defend the opinion of the prejudicial influence of such amount of copper upon health.

This represents our conclusion based upon the experiments we have described, and we think it probable that quite as much copper finds its way into the system through the handling of copper coins, the use of copper vessels in cooking operations, and in the consumption of pickles and such articles which are often prepared in copper vessels. At least we believe preserved peas are absolutely innocuous to health.

10. *Other Confirmatory Evidence of the Innocuous Nature of Traces of Copper present in Foods.*—In a prosecution case conducted before the Marlborough Street Police Court, on Monday, January 22, 1877, Dr. Pavy expressed the opinion that 0·31 of a grain of copper (sulphate?) would not be injurious to health; this opinion was unsupported by any evidence.

In what has gone before we have supplied the evidence required, and these results are confirmed by and confirmative of other results recently communicated by M. Galippe to the French Academy of Sciences.* He has found that the administration of large doses causes vomiting, but that the same compounds may be taken in increasing amounts for prolonged periods of time without the attendance of any painful symptoms. Galippe cites the experiments of Burq and Ducom, who fed dogs with food that had been cooked and cooled in vessels made of copper and previously exposed to the action of vinegar and salt; the dogs were not at all affected. Moreover, Galippe and his family have lived on food similarly prepared, without experiencing any poisonous effects.

11. *Other Alimentary Substances containing Metallic Compounds.*—It has, in some recent cases of prosecution, been brought to public attention that so-called sugar-cured American hams are coated with a composition containing chromate of lead, which is ordinarily regarded as an irritant to the stomach and an accumulative poison.

Similarly, sweets have been met with which have also been coloured with plumbic chromate, and in one instance one-fifth of a

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* *Comptes Rendus*, April 9, 1877.

grain of this substance was contained in an ounce of the sweets, while in another case, twice this quantity was detected.

It may be known, that a tolerably large business is now done in colours for sweets and other confectionery, and at various times very objectionable substances have been employed in compounding them; such for instance as salts of lead, chromium and arsenic, and more recently certain aniline colours.

Of late, stannic oxide has come largely into use for compounding these colours, its employment being liked on account of the bright tints which it induces when used as a lake. The colouring matters now chiefly employed are of vegetable origin; cochineal being almost the only animal colouring matter at all in use. Infusions of these colours are made, and they are then precipitated in various ways.

We have recently had occasion to examine a number of these colours of French manufacture, and found that they were largely contaminated with tin, the dry substance containing from 8 to 60 or even 75 per cent. of stannic oxide. Although a little of these colours goes a long way in colouring confectionery, it may nevertheless be very questionable whether the use of compounds containing so much tin should be considered admissible.

For some time past we have been engaged in an attempt to prepare colours of this nature, free from the objection attaching to the presence of such metallic combinations, and hope at no distant period to be successful in this object.

The President, in inviting discussion on this paper, said that as he had been rather prominently connected with some of the cases of prosecution to which Mr. Kingzett had alluded, he would prefer to hear observations made by others to offering any himself at present.

Mr. Siebold understood Mr. Kingzett to say that he found a small trace of copper even in fresh peas, and in several other instances he spoke of the same thing; he should like to ask therefore if any utensil were used containing copper or brass, the bunsen burner, or the retort stand, for instance, because a German chemist, named Ulex, proved ten years ago that small traces of copper might be found everywhere—even where they did not exist, that large quantities of liquid could not be evaporated over a bunsen burner the tube of which was made of brass without finding ultimately small traces of copper. Secondly, he should like to know how the copper had been estimated quantitatively; if it was by the method of precipitation in sulphide of hydrogen, and comparing the colour produced with that from a standard solution of copper, it was to a certain extent objectionable. His experience did not extend to copper, but this method was used to determine minute quantities of lead, and he had found that different preparations of lead produced a different shade of colour; chloride, sulphate, or nitrate producing different results. Some time ago, in testing a sample of tartaric acid with a small trace of lead in it, the discoloration produced by sulphuretted hydrogen was of a slate colour, instead of the brownish yellow generally obtained from water with lead in it, and on trying various preparations of lead he found they all differed in colour. Lastly, he protested against the notion that because copper was readily eliminated, it could not have any injurious effect. There were numerous medicinal agents, such as iodide of potassium, which passed through the system very quickly, and yet they had a physiological action, and in a large dose would have a poisonous action. Morphia was eliminated with the fæces, and not a trace of it with the urine; yet no one would deny that it passed through the system and acted as a poison.

Dr. Paul said this argument did not apply to the case in point, because the copper did not pass through the system at all; it was eliminated without even getting into the system.

Dr. Rowe said he had examined water from a stream in the county of Cornwall, which had been drunk from for many years by the inhabitants in the neighbourhood, and he found it contained large quantities of copper; in fact, so much that it could be profitably precipitated from it by iron, and yet those who used it appeared to suffer no inconvenience. At another place, called Llanarth, water similarly impregnated was used. Metallic matters were sometimes taken in large quantities and eliminated through the alimentary canal without apparently entering the constitution; for instance, some persons were not at all affected by taking iron, while others were greatly benefited by it. These instances fully confirmed his own idea that copper was not a blood poison or irritant, unless it were taken in the form of sulphate, or in some combination which rendered it an irritant.

Mr. Thompson said he had given a dog a grain of copper a day, Sundays excepted, for eighteen months, and the animal appeared to be quite unaffected by it.

Mr. Willmott said he had made some experiments with regard to the preservation of meat, and he came to the conclusion that it was absolutely necessary to exclude the air from it. He should like to know the results of the experiment undertaken by the President some time ago with paraffin, in this direction.

The PRESIDENT remarked that the general subject of meat preservation was not raised by the paper before them.

Mr. CHIPPERFIELD reminded the meeting that though vegetation was destroyed for miles round in the neighbourhood of copper works, and the flavour of copper could even be tasted in the air, still the longevity of those employed in the works would compare favourably with any other class of the population.

Dr. WRIGHT mentioned several cases which had been recently reported where persons had suffered more or less severely from partaking of preserved fruit or beverages, in which traces of lead were discovered. One was the case of a man who had been in the habit of obtaining beer at an early hour in the morning, which, from standing in the pipes during the night, had become contaminated, and after some months he showed well-marked symptoms of lead poisoning. In the same way the daily taking of minute quantities of copper might produce evil results after a time, though one or two doses might cause no inconvenience.

Dr. STEVENSON MACADAM dissented from the statement of Mr. Siebold that there was any uncertainty in determining the quantity of metallic poison present by the colour test, if the operation was properly carried out. In the case of lead, if different acids were employed at different times a difference in the result might be found, but in water testing, which was specially referred to, if acetic acid were regularly used and sulphuretted hydrogen, the results would be fairly comparable one with the others, and would indicate the quantity of lead present in the water. He had known several cases in which injurious effects had followed the use of preserved provisions, where it was evident the tin had been acted upon. He did not consider the presence of copper in the fæces as a positive proof that it had not been taken up by the system.

Mr. GROVES said there were some remarkable experiments on the use of copper salts reported in the *Journal de Pharmacie* a few months ago. In one case an individual had pushed it so far that his hair and nails became of a green colour, and yet he was reported not to have suffered in health.

Mr. ROBBINS asked if Dr. Rowe could state the quantity of copper found in the water he referred to.

Dr. ROWE said the sample he referred to last contained sixteen grains of copper in the form of sulphate per imperial gallon, and it was found remunerative to precipitate it by means of iron. He lived in the very heart of a copper mining district, in fact all the minerals spoken of that day were found within a thousand yards of his house, and all the streams were more or less affected. Still they were drunk of by animals, and more or less by human beings, though of course the water companies endeavoured to obtain their supplies from pure sources.

The PRESIDENT said the impression produced on his mind by the discussion was that the proposition that copper was not injurious to the system had been rather overproved. If they were to admit all that had been stated, they must go to the extent of saying that not only copper but other admittedly poisonous substances might be introduced into the system, as no doubt they might be under certain circumstances, without producing any marked injurious effects. Mr. Chipperfield alluded to the effects which were to be observed in the neighbourhood of copper works, where, as he said, you might taste the copper in the air. His own impression was that it was not copper, but sulphurous and arsenious acid, which one tasted; they knew that vegetation was destroyed to a very great extent, and by looking at the miserable horses and cows with swelled joints it was evident that animal life also suffered to an enormous extent. True, upon going into the works one saw both young and old not manifesting any signs of injury; but was it to be inferred from that that arsenious acid might be thrown into the atmosphere with impunity, and that it might be inhaled also without the risk of injury? He should hesitate long before coming to such a conclusion. The instances mentioned by Dr. Rowe were not conclusive to his mind, because he looked upon cases of that description as being of the nature of negative evidence, which told for very little when put against the positive evidence that had from time to time come under his notice. He might mention one very well authenticated case, in which a merchant in London had been using, in his family, some preserved greengages. After some time he began to suffer in health, with colicky pains, disagreeable taste in the mouth, swollen tongue, and other symptoms of metallic poisoning, and the preserved greengages being analysed at St. Bartholomew's Hospital were found to contain copper. Yet no other member of the family suffered at all. He could give another instance, where the well being out of order, a family had for some time to make use of rain water from a leaden cistern, and the lady of the house suffered from lead poisoning, but no one else, although all used the same water. Positive evidence of this description was far more conclusive than mere negative evidence. There were apparently some persons who were highly susceptible to influences of this description, and they would suffer materially where others would be quite unaffected. There was a question which was still debated, as to the extent to which persons suffered in health from occupying rooms hung with arsenical papers; and here again there were individual instances in which ill effects were experienced, whilst others would escape. Now this was a practical question, and it had been so treated by Mr. Kingzett, who referred to prosecutions having taken place for the sale of green peas which were found to contain copper; and he (Professor Redwood) had been engaged more prominently perhaps than many in such prosecutions. He had found that green peas imported from France contained copper to the extent of at least 2 grains of sulphate in a tin of 8 or 9 ounces, and when he considered that the public who purchased these articles did so in ignorance of the fact that they contained something which might be injurious, he had come to the conclusion that no dealer or manufacturer was justified in supplying an article of food which contained an unnecessary addition of a poisonous substance, put there merely to a give a particular colour, without notice being given of its presence. He did not profess to form a medical opinion on the subject himself, but as many medical men considered this addition injurious to health, he held that where such an article was sold, it should have a plain indication on the label that the contents were green peas "preserved with copper," and then the public might use them or act as they thought proper. This was the advice he had given to a dealer some time ago, who had a large stock of these articles on hand, and asked him what he should do with them. He said, if it was necessary that they should be sold, put a label on them indicating the presence of copper, and then the public would be responsible if any ill effects ensued.

Mr. Kingzett, in reply to Mr. Siebold's remarks, said he had found that with ordinary care the use of a brass bunsen burner did not cause the introduction of traces of copper into any matters which might be under examination for that substance; but to avoid even the possibility of an error arising from this source, Dr. Paul and he had employed an iron burner and platinum vessels. No great accuracy had been attempted in determining the amounts of copper, not deeming it a matter of great importance for their inquiry, but by ascertaining the intensity of colour presented by an ammoniacal solution of the copper, a good idea, better perhaps than by the sulphide colorimetric method, could be got. Dr. Wright had alluded to several cases of metallic poisoning that had been reported in the daily papers and with which they were all acquainted, but it was futile to institute comparisons between investigations which had been effected, and any it might be desirable to make. What Dr. Paul and he (Mr Kingzett) had advanced in their paper were facts relative to copper, and did not apply in any measure or manner to lead, tin, or zinc. One gentleman had suggested that although the copper was found in the fæces, it might previously have been in the system, but this idea was entirely opposed by the evidence. It should be considered that the various digestive processes take but a few hours for their completion, and that it is only during a particular part of that time, viz., while the food is yet in the stomach, that it is possible for the copper to be absorbed into the system. Now it had been shown that employing an imitative digestive process as much as forty or fifty hours were required to render soluble the small amount of copper contained in that quantity of peas which would be eaten at a meal. The probability, therefore, was that the greater part would pass through the intestinal canal without experiencing any change at all, and if it were required to show that the copper is not absorbed in any considerable measure, surely the fact that it is found in the first fæces passed after such a meal as he had described was sufficient to prove this. It was gratifying to hear from the meeting so much negative evidence (as it had been termed by Professor Redwood), confirmative of the positive evidence adduced by Dr. Paul and himself. People were too much carried away by opinion, itself a stumbling-block to investigation. What was medical opinion worth? nothing—unless it were based upon those precise facts necessary to its proper formation; and until Dr. Paul and he had investigated the physiological behaviour of the copper eaten with preserved peas, neither chemists nor medical men were competent to frame an opinion regarding it. The decisions arrived at in the various prosecutions referred to in the paper had depended upon the opinions of medical men or chemists, and inasmuch as these opinions were valueless, the decisions were unjust and affected trade in a mischievous manner. He (Mr. Kingzett) could not enter into the question as to whether a person was entitled to sell peas preserved green by the use of copper; that was irrelevant to the inquiry of Dr. Paul and himself; but he would say that if a person ate such peas, no harm could possibly result to his health from so doing.

A vote of thanks having been awarded to the authors of the paper, the Conference adjourned for luncheon.

Upon resuming, the next paper read was—

ANALYSES OF PRESERVED CARROTS, POTATOES, CABBAGE, AND MIXED VEGETABLES.

By Professor Attfield.

The influence of desiccation on vegetable substances, and the extent to which preserved vegetables differ from fresh vegetables, if indeed they differ at all or in any important degree, are matters of much interest to the pharmacist and medical practitioner, who frequently use dried herbs and dried parts of plants, and to the general public, who largely use preserved vegetable foods. As regards actual chemical alteration, probably little takes place if the perfectly sound and fresh fruit, root, leaf, stem, etc., be at once and rapidly dried at a moderately low temperature, or be quickly subjected to the selected process of preservation before any fermentative action commences. Possibly, however, active medicinal substances, such as alkaloids, may suffer alteration during reduction to the dry state, a point which will be cleared up as scientific investigation of these bodies becomes more extended. Of course, in cases where the process by which any given parcel of food has been preserved is not known, there will arise the suspicion that edible portions which do not readily lend themselves to the process may have been excluded, or that contusion of stems or bulky fruits, etc., may have resulted in partial loss of juice and of the alimentary bodies therein dissolved. The question also arises, does desiccation or other mode of preservation so physically alter constituents not chemically altered, as to impair the value of the vegetable substance, either as food or as medicine. The whole subject is a very large one, and to its full elucidation the present paper is only a very small contribution.

A few months ago, by request of the Chairman of the Admiralty Committee appointed to consider the causes of the outbreak of scurvy in the recent Arctic Expedition, I analysed samples of vegetables taken from the residual stores of the *Alert* and the *Discovery*, on the return of those ships to England.

The articles sent to me for analysis were:—

1. Fresh carrots, preserved in hermetically sealed tin cases.
2. Dried potatoes.
3. Dried compressed cabbage.
4. Dried compressed mixed vegetables.

These samples I so analysed as to admit of comparison being made between their composition and that of good average specimens of the respective vegetables recently removed from the ground.

The samples were all in good condition. The carrots from the tin were whole, sweet, juicy, and of full flavour; the dried fragments of potatoes were perfectly sound; the dried compressed cabbage was of good colour, crisp, and had the characteristic smell of the vegetable; the dried compressed mixed vegetables had an appetizing appearance, and the aroma of well-made vegetable soup.

1. *Carrots (cooked).*

The samples could not be distinguished in appearance from cold, soft, recently cooked carrots. Evidently they had been preserved in the tin by some mode of heating or steaming, similar to that employed in preserving meat in tins. Submitted to analysis they yielded :—

		In 100 parts by weight.
Water		89·13
Dry vegetable matter	10·21	10·87
Dry mineral matter	·66	
		100·00

The 10·21 parts of dry vegetable matter consisted of :—

Albuminoid matter	·98
Celluloid matter or fibre	1·14
Fatty matter	·29
Other non-nitrogenous matter	7·80
	10·21

And the 0·66 of dry mineral matter yielded (together with other less important substances) :—

Alkalies (as oxides)	0·31
Phosphoric acid (*i.e.*, phosphoric anhydride)	0·08

Carrots, like some other vegetables, absorb large quantities of water when cooked in that liquid. A fair average proportion of water in uncooked carrots is 85 per cent., a proportion which does not naturally vary very widely. That is to say, if 100 pounds of uncooked carrots were thoroughly desiccated, 15 pounds of solid matter would remain, and 85 pounds of water be dissipated—passing away as steam. Now, 100 parts of the cooked carrots just analysed only yielded 10·87 parts of solid matter; or, in other figures, 15 pounds of solid matter would be contained in 138 pounds of these soft, moist, cooked carrots. But assuming, as one must do for purposes of comparison, that we are dealing with the carrots in the uncooked condition—assuming that we have, not 138 parts of cooked carrots, containing a quantity of water absorbed during cooking, but 100 parts of uncooked carrots in the natural condition—assuming, in short, that the carrots when fresh contained the average proportion of 85 per cent. of water, then the composition of the sample would be as follows:—

Composition of the Carrots when uncooked.

(Based on the fair assumption that the fresh carrots contained the average natural and normal proportion of water, namely, 85 per cent.)

		In 100 parts by weight.
Water		85·00
Dry vegetable matter	14·09	15·00
Dry mineral matter	·91	
		100·00

The 14·09 parts of dry vegetable matter consisting of:—

Albuminoid matter	1·34
Celluloid matter or fibre	1·58
Fatty matter	·40
Other non-nitrogenous matter	10·77
	14·09

And the 0·91 of dry mineral matter containing (together with other less important substances):—

Alkalies (as oxides)	0·43
Phosphoric acid (*i.e.*, anhydride)	0·11

But, in truth, whether preserved carrots contain more or less water, is a matter of inferior importance. The question of chief moment is whether or not the components of this food bear to each other a proper ratio, whether or not any of these components have been "washed out," so to say, during the preserving process, the food maintaining its sensible characters, but having lost some essential constituent, some valuable property. The answer to this question in the case of the sample analysed was at once afforded on comparing the figures (just given) with those (in the next table) showing the average composition of good sound carrots freshly removed from the ground. It was then at once evident that the preserved carrots were as sound and good as the fresh natural vegetable, and that there was no practical difference between the carrots from the sample tin and carrots cooked within a few hours of their removal from the ground.

Average Composition of fresh uncooked Carrots.

(The figures give averages—calculated by Wolff and Knop—of all trustworthy analyses published up to August, 1865.)

	In 100 parts by weight.
Water	85·0
Dry vegetable matter	14·0
Dry mineral matter	1·0
	100·0

The 14 parts of dry vegetable matter consisting of:—

Albuminoid matter	1·5
Celluloid matter or fibre	1·7
Fatty matter	·2
Other non-nitrogenous matter	10·6
	14·0

And the 1 part of dry mineral matter yielding (together with other less important substances):—

Alkalies (as oxides)	0·59
Phosphoric acid (*i.e.*, anhydride)	0·12

Only in the proportion of "alkalies" was any important difference observable. Instead of an average of, say, 0·6 per cent., or a minimum of 0·5, there was only 0·43 per cent. in the original uncooked carrots. The deficiency is not great, and was quite accounted for on examining the small quantity of water which had exuded from the carrots in the tin. This water was rich in alkalies. But, as just stated, it was small in quantity, and, moreover, would probably be turned out of the tin with the carrots at meals, and be swallowed with the vegetable.

I may add that by direct experiment I find that carrots absorb large quantities of water during cooking, hence the assumption that the cooked carrots contained additional water to that occurring in them in the natural state was well founded.

2. *Dried Potatoes.*

The sample yielded:—

	In 100 parts by weight.
Water	12·17
Dry vegetable matter	83·57
Dry mineral matter	4·26
	100·00

The 83·57 parts of dry vegetable matter contained :—

Albuminoid matter	9·81
Celluloid matter or fibre	1·83
Fatty matter	·28
Other non-nitrogenous matter	71·65
	83·57

And the 4·26 of dry mineral matter yielded (together with other less important substances) :—

Alkalies (as oxides)	2·36
Phosphoric acid (*i.e.*, anhydride)	0·53

Composition of the original undried Potatoes.

(Based on the fair assumption that they contained the average natural proportion of water, namely, 75 per cent.)

	In 100 parts by weight.
Water	75·00
Dry vegetable matter	23·79
Dry mineral matter	1·21
	100·00

The 23·79 parts of dry vegetable matter consisting of :—

Albuminoid matter	2·80
Celluloid matter or fibre	·52
Fatty matter	·10
Other non-nitrogenous matter	20·37
	23·79

And the 1·21 parts of dry mineral matter containing (together with other less important substances) :—

Alkalies (as oxides)	0·67
Phosphoric acid (*i.e.*, anhydride)	0·15

Average Composition of Potatoes.

(The mean of many published analyses.)

	In 100 parts by weight.
Water	75·0
Dry vegetable matter	24·1
Dry mineral matter	·9
	100·0

The 24·1 parts of dry vegetable matter consisting of:—

Albuminoid matter	2·0
Celluloid matter or fibre	1·0
Fatty matter	·2
Other non-nitrogenous matter	20·9
	24·1

And the 0·9 of dry mineral matter containing (together with other less important substances):—

Alkalies (as oxides)	0·55
Phosphoric acid (*i.e.*, anhydride)	0·17

A glance at the second and third of these three tables relating to the sample of potatoes, will show that the dried potatoes supplied to the ships were, from the chemical point of view, of good quality, containing all the chief components of the sound normal vegetable, and containing them in natural proportion. The first table interpreted in the light of the second and third shows, further, that one pound of such dried potatoes represented three and a half pounds of undried potatoes.

Not only were the potatoes chemically good, but their general condition was excellent. No trace of mouldiness, sourness, or other undesirable quality could be detected.

3. *Dried compressed Cabbage.*

The sample yielded:—

	In 100 parts by weight.
Water	19·93
Dry vegetable matter	74·18
Dry mineral matter	5·89
	100·00

The 74·18 parts of dry vegetable contained:—

Albuminoid matter	13·01
Celluloid matter or fibre	9·45
Fatty matter	2·56
Other non-nitrogenous matter	49·16
	74·18

And the 5·89 of dry mineral matter yielded (together with other less important substances):—

Alkalies (as oxides)	1·75
Phosphoric acid (*i.e.* anhydride)	·64

Composition of the original undried Cabbage.

(Based on the fair assumption that it contained the average natural proportion of water, namely, 89 per cent.)

	In 100 parts by weight.
Water	89·00
Dry vegetable matter	10·36
Dry mineral matter	·64
	100·00

The 10·36 parts of dry vegetable matter consisting of:—

Albuminoid matter	1·43
Celluloid matter or fibre	1·03
Fatty matter	·28
Other non-nitrogenous matter	7·62
	10·36

And the 0·64 parts of dry mineral matter containing (together with other less important substances):—

Alkalies (as oxides)	0·19
Phosphoric acid (*i.e.* anhydride)	0·07

Average Composition of Cabbage.

(The mean of several published analyses.)

	In 100 parts by weight.
Water	89·0
Dry vegetable matter	9·8
Dry mineral matter	1·2
	100·0

The 9·8 parts of dry vegetable matter consisting of:—

Albuminoid matter	1·5
Celluloid matter or fibre	2·0
Fatty matter	·4
Other non-nitrogenous matter	5·9
	9·8

And the 1·2 of dry mineral matter containing (together with other less important substances):—

Alkalies (as oxides)	0·63
Phosphoric acid (*i.e.* anhydride)	0·20

The figures of these tables of the composition of the sample of cabbage, show that while the vegetable constituents are in good proportion, there is considerable deficiency in mineral matter, especially of the saline material termed alkaline phosphate. In the first place, 0·64 per cent. of mineral matter is not only about half the average proportion, but is much less than the minimum hitherto obtained from cabbage. And in the second place, only about one-third of this already small amount of mineral matter is "alkalies," whereas half the mineral matter should be of this character. Thirdly, the phosphoric acid, or rather phosphoric anhydride, is present to only about one-third the normal proportion.

As to the physiological import of so great a deficiency of alkaline phosphates in this sample of cabbage, I do not pretent to judge. At the same time, eminent authorities consider that these saline constituents of vegetables contribute very materially to the food value of the vegetables.

As to the cause of the deficiency, the chemical results are suggestive of loss of juice from the original cabbage. If the fresh cabbages were submitted to pressure before drying to such an extent as to bruise the leaves and cause an outflow of juice, that would exactly explain the facts revealed by the analysis.

I may add that experiments undertaken with the view of ascertaining whether the cabbage yielded as much organic acid as a sample taken from my own garden, also pointed to loss of juice from the original cabbage. One pound of dried cabbage represents, in weight, seven pounds of the fresh vegetable.

4. *Dried compressed mixed Vegetables.*

The sample yielded :—

	In 100 parts by weight.
Water	15·61
Dry vegetable matter	80·29
Dry mineral matter	4·10
	100·00

The 80·29 parts of dry vegetable matter yielded :—

Albuminoid matter	8·11
Celluloid matter or fibre	4·94
Fatty matter	1·82
Other non-nitrogenous matter	65·42
	80·29

And the 4·1 of dry mineral matter yielded (together with other less important substances):—

Alkalies (as oxides)	1·82
Phosphoric acid (*i.e.* anhydride)	·47

Composition of the original undried mixed Vegetables.

(Based on the assumption that they contained 85 per cent. of water.)

	In 100 parts by weight.
Water	85·0
Dry vegetable matter	14·3
Dry mineral matter	·7
	100·0

The 14·3 parts of dry vegetable matter containing:—

Albuminoid matter	1·5
Celluloid matter or fibre	1·0
Fatty matter	·3
Other non-nitrogenous matter	11·5
	14·3

And the 0·7 parts of dry mineral matter containing (together with other less important substances):—

Alkalies (as oxides)	0·31
Phosphoric acid (*i.e.* anhydride)	0·08

There are no published analyses of "mixed vegetables," and if there were, the mixture might not be similar to that of the sample. I should form the opinion that the sample of mixed vegetables, like that of the cabbage, though not to the same extent, had lost a portion of its original juice—perhaps by pressure—and, consequently, a portion of its valuable saline constituents.

Organic Acids.—Some experiments, commenced with the object of ascertaining the proportion of organic acids in the vegetables, led to no useful results. Comparative experiments with fresh and preserved vegetables were tried, but were abandoned. Larger samples of the preserved vegetables, and much time would be necessary for such an investigation.

Conclusions.

The results of the analyses and general examination may be restated shortly as follows:—

1. The carrots were of good quality.

2. The potatoes were of good quality.
3. The cabbage was deficient in important saline constituents.
4. The mixed vegetables are probably somewhat deficient in saline substances.

Whether or not these conclusions may be applied to the similar preserved vegetables supplied to the public generally cannot be decided until more analyses have been published.

The President said he should like to know if Professor Attfield had any reason to suppose that these vegetables had been preserved by the method commonly adopted. Some years ago several papers were published on the preservation of vegetables by a process of drying as well as pressing, and if that method were adopted he could not understand how the deficiency noticed arose. He presumed the desiccation was mainly caused by pressing out the juice; if, however, vegetable substances could be preserved without the separation of any of the component parts and without any deterioration taking place, it might be of importance in pharmacy. Dried medicinal herbs underwent considerable changes, and sometimes became inert, and attempts had been made to preserve them in a humid condition, but hitherto these efforts had proved failures.

Mr. Groves asked if Professor Attfield had discriminated between potash and soda in his analyses, because it was supposed that scurvy was due to the absence of potash in the food.

The President said it would be interesting to know if any material change had taken place in the colour of the vegetables.

Mr. E. Smith remarked with reference to the preservation of medicinal herbs, that a great mistake is made in drying them at too high a temperature. Dry air at a comparatively low temperature was the best for such a purpose.

Mr. Willmott asked what Mr. Smith considered a high temperature for preserving herbs.

Mr. Smith said it was very common to have a room specially heated for drying hemlock, henbane, and such plants; but if a low temperature were employed, with dry air, there would be a much better product. It would be all the better if the air could be passed over ice if it were kept dry.

Dr. Symes thought the thing to aim at was to strike the happy mean between the use of too high a temperature and keeping the plants about too long in the process. If vegetable substances were kept for any length of time, especially if they were not in very thin layers, a process of fermentation was likely to be set up, and although they might appear green they would be changed more or less in their character. It should be ascertained by experience how long it would be safe to keep them about, and then as low a temperature as possible employed.

Mr. GREENISH said the green colour was due to the presence of chlorophyll, an active agent in the process of assimilation, and it was a question whether a temperature capable of acting on so delicate a substance as chlorophyll would necessarily have any influence on the product of assimilation previously formed; the loss of that bright green colour did not necessarily imply that the active principle was injured, and he should question whether the loss of the green colour really injured the product. He should like to know if Mr. Smith had observed any instances of henbane being thus injured.

Mr. SMITH said this was not an easy question to answer; but he thought he had observed that a better tincture was obtained from hemlock and henbane when dried at a low temperature. It was fairly reasonable to suppose that a high temperature tended to produce a decomposition of the active principle.

Mr. UMNEY said he had had many years' experience in the drying of medicinal herbs, more especially those of conium, digitalis, belladonna, and henbane. Henbane was the most difficult herb to dry, on account of its extreme succulence. He generally employed frames made of cane threaded into thin pieces of deal about four or five feet long, the canes being arranged about half an inch apart. These were put into a room built round a steam boiler, and he had generally found if these frames were put into the room at two or three o'clock in the afternoon they might be taken out next morning with their contents perfectly dry, without any sign of decomposition. On the other hand, he had seen large quantities of belladonna hopelessly spoiled from attempting to force the process. Henbane was chiefly supplied to the London market by growers in Lincolnshire and Cambridgeshire, and Oxfordshire, and the leaves came to market kiln dried. The temperature of the room about the boiler was from 140° to 150° Fahr., probably sinking to 110° during the night.

Mr. SMITH asked what Mr. Umney would consider a sign of decomposition in henbane leaves.

Mr. UMNEY said he had seen henbane leaves, when packed too thickly upon the drying frames he had described, quite brown and literally stinking, whereas a leaf properly dried maintained its green character and when it was touched it crumbled to powder. To finish the leaves elegantly they should be rubbed through a sieve and the midribs taken out.

Mr. Balkwill asked whether in the case of a plant such as henbane, the leaves only of which were used, it would be better that the leaves should be separated from the stalk before drying; or in other words, whether the sap receded during drying from the leaf into the stem, or from a succulent stem into the leaf. In reference to drying herbs, his own experience this summer had been in drying digitalis, conium, and one or two others, that very unsatisfactory results were obtained by drying them in a room where there was not a thorough circulation of air. The remarks of the President had turned his thoughts to a preparation which was very important, and would no doubt be much more used if it were not so uncertain, namely, elaterium. If the juice or the fresh fruit could be preserved, it would be a very great advantage, because practically no difference was observable between the active elaterium extract and the one inert from age. Again, would it not be possible to preserve the expressed juices of plants in hermetically sealed tubes without the addition of any spirit? In the presence of so many practical men he threw it out as a suggestion. He had a hope that the juices as freshly pressed from medicinal plants might in this way be preserved for dispensing. The Pharmacopœia expressed juices were unsatisfactory, inasmuch as they do not keep well.

Mr. Willmott feared that any such attempt would prove a failure. He believed the sources of decomposition resided rather in the thing itself than in the atmosphere, and that unless the sealed tube was submitted to a temperature sufficient to destroy any germs present in the fluid it would be certain to decompose.

Professor Attfield said he had no information how the substances he had examined were dried. The carrots in the sealed tins were perfectly fresh and juicy. With respect to colour, the dried cabbage had a green colour, though perhaps not quite so green as the fresh vegetable. When soaked for two hours in water it absorbed nearly the normal amount of water present in fresh cabbage, and had a most appetizing appearance. When the dried carrots were soaked for a few hours, they swelled up and were found to have absorbed about nine-tenths as much moisture as would be present in the fresh vegetable. He had reason to believe that nearly the whole of the alkali-metal salts present were those of potassium. He knew very little with regard to the best temperature for drying herbs, but from what he did know, he quite agreed with the remarks of Mr. Smith and Dr. Symes. He hoped the remarks of Mr. Balkwill, suggestive as they were of unequal medicinal activity of different parts of herbs, would be taken up by some pharmacist, and form the subject of a future communication to the Conference or to the Pharmaceutical Society.

The next paper read was on—

THE CHEMICAL CONSTITUENTS OF CONVOLVULUS SCAMMONIA.

By Charles T. Kingzett, F.C.S.; and Thomas Farries, F.C.S.

On what has been called the blue list of the British Pharmaceutical Conference, convolvuline, from the roots of *Convolvulus scammonia*, finds a place amidst the alkaloids of doubtful existence. It was with the view of arriving at more definite knowledge regarding this doubtful alkaloid that we commenced a research some months ago.

The roots (7 lbs. direct from Smyrna) were first of all extracted thoroughly with tolerably hot water, and after this with alcohol of 85 per cent., and finally with ether. The ether extract contained apparently only a little matter of similar nature to that extracted by the alcohol.

Treatment of Water extract.—This was of a faintly acid reaction and dark colour. It was strongly acidified by nitric acid, whereby a bulky albuminous looking precipitate was thrown down, which afterwards proved mainly insoluble in water, and was not further examined. The clear filtrate was fully precipitated with phosphomolybic acid solution, and the considerable precipitate thus obtained was washed first with dilute nitric acid, and finally with water acidified by sulphuric acid. The precipitate was then decomposed with excess of boiling baryta water, filtered from the baric-phosphomolybdate, and the excess of barium removed by carbonic anhydride; the last traces being taken out by an exact amount of sulphuric acid. The ultimate solution was alkaline in reaction, and was now neutralized by hydrochloric acid, and concentrated. The product gave no precipitate with aqueous solution of platinic chloride, but yielded a bulky one with alcoholic platinic solution, which was recrystallized from water. On analysis, it proved to be the pure double chloride of potassium and platinum. Therefore, *Convolvulus scammonia* contains no alkaloid soluble in water.

Examination of the Alcoholic extract.—When concentrated, this formed a golden yellow syrup, from which water precipitated a stringy bright yellow mass soluble in ether.

It was several times reprecipitated from alcohol by water, and it then gave both with sulphuric acid and sugar, and with sulphuric acid alone, the purple reaction yielded, as Hake and one of us have shown, by most so-called glucosides and other bodies.*

A quantity of it was boiled with a two per cent. sulphuric acid solution during 20 hours, filtered, the sulphuric acid removed by baryta water, and the excess of this reagent by carbonic anhydride. The filtrate on evaporation to dryness left a glucose-looking mass containing barium in combination, and which gave the ordinary reactions of glucose; that is to say, it gave with camphor and strong sulphuric acid the purple colour explained in the paper referred to above. It charred with sulphuric acid like sugar; its solution readily reduced Fehling's copper test, and also nitrate of silver. It was dried at 100° C., powdered and analysed. ·309 gram gave 0·137 gram H_2O, the carbon determination was ruined by an accident; ·4858 gram gave 0·286 gram $Ba\,S\,O_4$.

These numbers give 4·92 per cent. H and 34·61 per cent. Ba.

From these percentages it will be seen that the barium stands to the hydrogen as 1 : 19·5 atoms. In a similar substance obtained by a like process from hederic acid, a corresponding barium salt was obtained, when the relation of barium to hydrogen was also 1 : 19.

A barium salt of glucinic acid, having the formula $C_{12}\,H_{16}\,Ba\,O_9$, would contain 31·06 per cent. Ba and 3·62 per cent. H; while glucosate of barium, $2\,(C_6\,H_{11}\,O_6)\,Ba$, requires 27·8 per cent. Ba and 4·44 per cent. H. There can be little doubt that the substance whose analysis is given above, represents an intermediate state, occurring in the spontaneous change of glucosate into glucinate of barium. Of its relation to sugar there is no question.

A similar substance, which, however, we have not analysed, is obtained by treating the resin with strong sulphuric acid, diluting, filtering, and submitting the filtrate to the same process as that resulting from boiling the resin with dilute acid.

Again, the same substance appears to be produced in, and may be similarly extracted from the black and shining residue left in the retort when scammony resin is submitted to dry distillation.

Under these last-named circumstances another product is also obtained as a distillate.

At 82° C. an oily body began to condense from the heavy vapours which formed, and between this temperature and 90° C. several grams of the distillate were obtained. It constituted a somewhat volatile liquid, of a yellowish colour and pungent aromatic odour;

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* *Pharm. Journ.*, May 12, 1876.

its further examination and analysis is reserved for a future opportunity.

Cl. Marquardt* has described the resin obtained from the root of *Convolvulus scammonia*, and believed he had separated a vegetable base, but from our observations it would appear that Marquart was in error.

Scammony resin has been described by a number of chemists, including Bouilhon, Lagrange and Vogel, Planche, Johnston, Spirgatis, Mayer, Keller, and Koomann.

From all accounts, scammony resin appears to differ little from jalapin. Some authors say that the resin derived from certain species of convolvulus is insoluble in ether; that which we obtained and examined was easily soluble in ether, and in this respect, therefore, resembled jalapin (from jalap stalks).

From the analyses of jalapin agreeing fairly among themselves, various formulæ have been constructed; that generally accepted is $C_{34}H_{56}O_{16}$, containing 56·66 per cent. C, 7·77 per cent. H, and 35·57 per cent. O.

Jalapin is stated, by various authors, to split up under the influence of dilute acids as follows:—

$$2\,C_{34}H_{56}O_{16} + 11\,H_2O = C_{32}H_{62}O_7 + 6\,C_6H_{12}O_6.$$

Jalapin + water = jalapinol + glucose; while jalapin from scammony resin is represented as splitting up in this way—

$$C_{34}H_{56}O_{16} + 5\,H_2O = C_{16}H_{30}O_3 + 3\,C_6H_{12}O_6.$$

Scammony resin + water = jalapinolic acid + glucose. That scammony resin is a glucoside and yields glucose by proper treatment, is supported by the foregoing observations.

Mr. Williams asked if Mr. Kingzett had isolated the alkaloid in any way.

Mr. Kingzett said he had already stated that he had found there was no alkaloid: he got a platinum salt which proved to be a potassic combination only.

Mr. Groves said it was not a new fact that scammony contained both a resin acid and a resin glucoside.

Mr. Kingzett said that although certain kinds of jalap stalks had been examined, and a resin obtained which on boiling with dilute sulphuric acid reduced Fehling's test, he had not found any analyses

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* *N. Br. Arch.*, vii., 248; x., 139.

of the sugar thus assumed to be produced. Chemists were too often satisfied with obtaining the reduction of Fehling's test as being sufficient to establish the presence of sugar, but he had analysed the substance itself.

Mr. WILLIAMS reminded Mr. Kingzett that Dr. Williamson about twenty years ago published a very elaborate paper on this subject.

Mr. KINGZETT said he believed he was acquainted with all the literature of the subject.

Mr. UMNEY thought every manufacturer must have noticed the presence of glucose in scammony root. During the past eight or nine years he had operated on many tons of the root, and always found in the alcoholic extract a large quantity of uncrystallizable grape sugar, and he remembered the late Mr. Daniel Hanbury having 3 or 4 pints of this thick, treacly substance from him to see if he could crystallize it. As he understood Mr. Kingzett's process, the whole of the saccharine matter would be removed by treatment with water at 70° C. He had generally allowed the crude resin as obtained by alcohol to stand two or three days in contact with water, in which it was boiled, the saccharine solution being removed again and again.

The next paper read was on—

FURTHER RESEARCHES ON TEA HAIR.

By THOMAS GREENISH, F.C.S.

Under the name of Pekoe Flower, or Flower of Tea, this substance was brought before the Conference at Glasgow last year by Mr. Groves, and on that occasion I gave the result of its examination, mainly microscopical, which I had previously undertaken. At that time but little was known either by Mr. Groves or myself of its history, the position it occupied in commerce, or its ultimate destination. I followed up the subject with the view of supplying for this meeting that more complete information which was wanting on these several points, as the tea hair may probably crop up again as a natural curiosity for a lover of science, or to supply a sensational paragraph for a public analyst.

The tea hair was said to have emanated from a house in the city, but the city is a large place in which to look for tea hair, and I found it so. For many months I worried with my inquiries tea brokers and tea merchants, but without result, until at last a friendly hint directed me to a tea broker's office, where I found a member of the firm who, in addition to a very discriminating palate as regards the strength and flavour of tea, had also acquired a vast deal of collateral information about teas imported from India and China.

It appears that tea hair finds its way into this country as an article of legitimate commerce, at tolerably regular intervals; its commercial name is "Pekoe Flower," and sometimes the "Bloom of the Pekoe Flower." It is a product of India teas, not of those of China. It is purchased somewhat as a curiosity, but there are those who buy it pretty regularly. Pekoe flower is never sold as tea simple or for mixing with tea. It is almost a necessity that it should be sold alone. If it be mixed with ordinary tea there is such a tendency to the separation of the tea hair and its agglomeration into lumps, that any attempt of this kind would probably result in the whole being returned as an adulterated tea.

In an essay on the cultivation and manufacture of Indian teas by Lieut.-Col. Money, and published in Calcutta, the whole process of the manufacture of the Indian teas is given, and it is not difficult to trace the condition in which this tea hair is found, to its origin. One part of the process consists in what is called "rolling" the leaves, when the juice is given out freely; and as to its results on the leaf, he says, "If the leaves which give Pekoe tips are separated from the other leaves and rolled *very little* and *very lightly* there will come out Pekoe tips of a whitish colour; if *not* separated from the other leaves, but manufactured with them, the sap from the other ves, expressed in the rolling, stains these said leaves, which are covered with a fine silky down, and makes them look like the rest of the tea." This is evidently the part of the process in the manufacture of Indian teas which gives to the otherwise greyish-white hair its brown colour, and also that extractive matter which is found adhering to it.

Mr. Wigner, in his analysis of the tea hair, gives theine 1·5 per cent. as compared with 3·5 per cent. for Pekoe tea, and Mr. Groves remarks in reference to this, that "it is interesting to find theine present in the tea hair." I doubted the correctness of this conclusion. The hair of the leaf is an extension of the epidermal cells covered by the cuticle; there is an absence of chlorophyll, the cells being empty; this layer prevents too rapid evaporation from the parenchyma of the leaf, but plays no part in the plant's economy. I have no doubt but that the theine obtained by Mr. Wigner was derived from extractive and parenchymatous tissue adherent to the base of some of the hairs. To determine this point, I took 100 grs.

of tea hair, exhausted it with cold water and evaporated the liquid to dryness. It yielded 15 grs. of extract; this closely agrees with the result obtained by Mr. Wigner. My object was now qualitative, to determine the presence of theine in the extract, and for this I adopted the micro-sublimation process. A little of the extract was dissolved in water, to which was added some calcined magnesia; the solution was boiled and evaporated to dryness; part of it was then placed in a cell on one glass slide covered by another, and at a temperature of about 120° C. I obtained successive crops of theine in acicular crystals. I then subjected the hair from which the extract had been obtained to the same process, but there was no indication in the hair freed from extractive of the presence of theine. It is evident that this experiment on the exhausted hair could not be considered conclusive as to the absence of theine in the normal hair of the tea leaf. I further picked carefully clean hairs from young Pekoe leaves, treated them in the same manner by gently boiling with a little calcined magnesia, and employed the same micro-sublimation process, but failed to get the slightest indication of the presence of theine in the hair itself when free from extractive matter and parenchymatous tissue. These experiments are to my mind conclusive that the theine was obtained from the extractive matter and parenchyma of the plant, and that there exists no theine in the normal hair of the tea leaf, and I believe that there is no known instance of a simple hair, such as that on the tea leaf, containing the active principle of the plant.

A further careful examination of the tea hair, besides calcareous matter, shows the presence of minute particles of the elytra of beetles, the markings on which bear a close resemblance to the venation of a leaf, and which may easily be mistaken for fragments of some leaf other than tea.

I may add that the tea hair has created considerable interest, and and I have been applied to from the continent for museum samples, which until lately I was quite unable to supply.

Thanks having been voted to Mr. Greenish for his paper,

Mr. Groves said he could have saved Mr. Greenish a great deal of trouble if he had known that he was in search of the importers of the tea hair. It was no mystery—he had known all about it from the first. The general impression was that this tea hair was worked up into the compressed tea, as the only way of getting rid of it. As to the presence of theine, the presumption was in favour of Mr. Greenish's theory that it was not present.

The next paper read was on—

COPAIBA TESTING.

By Louis Siebold.

All who have been frequently engaged in the testing of copaiba will have noticed that most of the tests described in standard works on materia medica and pharmaceutical chemistry, though applicable to some kinds of copaiba, are quite untrustworthy as general tests for the purity of this oleo-resin. I will deal with these tests one by one before giving what I conceive to be a simple and thoroughly reliable mode of ascertaining the presence or absence of adulterants in any sample of this substance.

1. *The Specific Gravity.*—This, like the consistence of the balsam, varies considerably, according to the proportions of resin and volatile oil present in the samples. Some authors give it as ·95 to ·96, others as ·94 to ·97, and others again as ·94 to 1·0. Having experimented with a large number of samples of different origin, I am in a position to state that the range of variation is much greater than is generally supposed, as I find the limits to be ·915 and ·995. Equally variable are the relative proportions of resin and oil. The smallest proportion of resin I have ever met with was 18½ per cent., whereas the usual range is from 30 to 65 per cent. Such variations are by no means surprising considering that the oleo-resin is obtained from many different species of copaifera growing in different localities and under different climatical influences, and that these circumstances, together with the age of the trees, the time and mode of extraction, and the age of the balsam itself, are sure to have a material influence on its chemical composition.

2. *Appearance.*—All kinds of copaiba as imported are turbid, and require to be filtered before they can be sent out to retail dealers. The colour varies as much as the consistence and specific gravity. The British Pharmacopœia states that copaiba should not be fluorescent, and this statement occurs again in the majority of books I have consulted. Flückiger and Hanbury, however, admit that it is sometimes slightly fluorescent. My own experience is that very many genuine samples of copaiba are distinctly and many others slightly fluorescent, and that very few samples indeed are quite devoid of this property.

The Benzol Test.—According to the British Pharmacopœia, copaiba should be soluble in an equal bulk of benzol. This as a test is quite useless, since all the known adulterants of copaiba are likewise soluble in benzol.

The Magnesia Test.—Pure copaiba is stated to be capable of dissolving one-fourth of its weight of magnesium carbonate by the aid of heat, and remain transparent; if not, an adulteration with a fixed oil, or with gurjun oil, is to be inferred. The test, however, is quite fallacious, as it only answers with the thicker specimens of Maranham balsam. The power of copaiba to dissolve that quantity, or anything approaching that quantity, of magnesium carbonate, depends on the presence of a large amount of acid resin (copaivic acid), and unless we are prepared to condemn all samples of Para and nearly all the thinner kinds of Maranham balsam as adulterated, the test must be dismissed as useless.

The Ammonia Test.—One part of copaiba with two and a half or three parts of solution of ammonia is to produce a clear mixture. This test is fallacious for the same reasons as the magnesia test.

The Alcohol Test.—The statement met with in some books that copaiba is perfectly soluble in rectified spirit is true only with regard to certain balsams. The great majority of samples of genuine copaiba are not soluble in that menstruum. Nearly all authors, however, agree that one volume of copaiba ought to form a perfectly clear solution with three volumes of absolute alcohol. Nevertheless this statement too is incorrect, for the thinner balsams, and especially those of Para, form a cloudy mixture with absolute alcohol, which after prolonged standing deposits some white or yellowish-white resinous flakes. Yet this test, if carefully applied, is of some value, for in the presence of a fatty oil other than castor oil, the sediment just mentioned, instead of consisting entirely of resinous flakes, will contain drops of the oil. On the whole, however, I do not care very much for this test; it fails with castor oil, and is in every respect inferior to the simple process of evaporation, to which I shall refer presently.

Muter's Test.—The details of this process were published in the *Analyst* of November 30, last year, and reprinted in the *Pharmaceutical Journal* of December 30. They may be briefly summarized as follows:—The alcoholic solutions of a weighed quantity of the balsam is saponified with an excess of caustic soda, the soap solution mixed with water, then evaporated to a given bulk, the excess of alkali neutralized with sulphuric acid, the whole evaporated to dryness and the dry residue treated with a mixture of ether and alcohol, which will dissolve the sodium copaivate, leaving undissolved the sodium sulphate, and any sodium oleate which, in the presence of a fatty oil, must have been formed. The insoluble matter is then taken up with warm water, the solution decomposed by hydrochloric acid, and the liberated oleic acid carefully collected, dried, and weighed. As copaiba contains a small quantity of altered resin, the soap of which is not readily soluble in the ether alcohol, Dr. Muter makes an allowance of 6 per cent. for this resin, which must be deducted from the precentage of oil, calculated from the analysis. Another correction has to be made in consideration of the slight solubility of sodium oleate in ether alcohol, which, according to M. Barfoëd amounts to 1 in 1000. By means of this process Dr. Muter has obtained results showing a very high degree of accuracy. In two cases out of six the amount of oil found agreed within $\frac{1}{10}$ of a per cent., and in the remaining cases, with the exception of one, within 1 per cent of the amount actually present. I have carefully repeated Dr. Muter's experiments, thinking that though there are much simpler means available for the detection of fatty oils, the great accuracy attained would fully justify a somewhat tedious and troublesome process. My results, however, do not agree with those of Dr. Muter, as will be seen from the following numbers:—

	Oil present.			Oil found.
No. 1.	15·7 per cent.	(linseed)	.	12·1 per cent.
No. 2.	38·2 ,,	(linseed)	.	29·5 ,,
No. 3.	11·6 ,,	(castor)	.	5·4 ,,
No. 4.	51·1 ,,	(castor)	.	39·6 ,,
No. 5.	5·1 ,,	(linseed)	.	none
No. 6.	27·3 ,,	(castor)	.	21·4 ,,

I have in all examined ten mixtures of balsam and oil, but am only quoting the numbers in those cases in which several analyses gave concordant results. My conclusion therefore is that the method is not accurate enough to warrant the trouble and expenditure of time. As a qualitative test it is very unsatisfactory and far too troublesome; in the presence of 5 per cent. of oil it completely fails to indicate the adulteration, and with 10 per cent. it gives an indistinct result. On the other hand, it will be seen from the following that the simple process of evaporation shows the presence of 1 per cent. of oil, and also admits of a rough calculation of the amount of adulteration.

Evaporation.—This is an excellent and exceedingly simple test, but is clumsily applied by many. Instead of boiling the balsam with water for many hours, a small quantity (about 1 to 1·5 gram) of the sample should be carefully heated in a watch-glass until all the oil is driven off, which is the case as soon as the residue has assumed a rich brown colour. A few minutes suffice for the experiment. If the remaining resin is perfectly brittle and pulverizable, there is no fatty oil present, for 1 per cent. of oil would diminish the brittleness of the resin so that it cannot be reduced to a fine powder. One per cent. of oil is thus readily detected, and with larger quantities of the adulterant (3 to 5 per cent.), the resin feels quite sticky. On heating the resin, castor oil and linseed oil may be distinguished by the odour. By mixing the adulterated balsam with ten, twenty, thirty, forty, and fifty volumes of pure Maranham balsam respectively, and testing each dilution in this manner, it is easy to find in which the oil has been reduced to below 1 per cent., and thus to ascertain whether the adulterant amounted to more than 10, 20, 30, 40, or 50 per cent.; and this I think would be sufficiently near the mark for the purpose of public analysts. Mr. Conroy, of Liverpool, who has also had considerable experience in copaiba testing, informs me that he too relies on the evaporation as the best and by far the simplest mode of detecting fatty oils, and agrees with me as to the sensitiveness of the test. He places a drop of the hot resin (after evaporation of the essential oils), on a small piece of well glazed note paper; if the balsam be pure, the resin will fly off in hundreds of fragments on bending the paper when cold. I have examined upwards of twenty different samples of copaiba, each mixed with linseed oil and with castor oil in eight different proportions and have come to the conclusion that if a sample leaves a pulverizable resin on evaporation, all further testing with alcohol and other reagents for fused oils is merely a waste of time.

Detection of Gurjun Oil.—Flückiger's test with bisulphide of carbon and a mixture of nitric and sulphuric acids, as described in the "Pharmacographia," is a good one, especially if applied to a drop of the essential oil separated from the balsam by distillation with water. Its application direct to the balsam requires practice to prevent errors. Hager's test with petroleum ether, mentioned in the *Year-Book of Pharmacy* for 1876, is also a good one; I have tried it extensively, and have every reason to be satisfied with it. A pure balsam when mixed with four volumes of petroleum ether yields a clear solution, which either remains clear on standing or forms an exceedingly slight deposit, coating the bottom of the tube like a thin film. In the presence of gurjun oil, however, a voluminous sediment is formed in the mixture after half an hour's standing. Benzol cannot be used for this test, and is the more unsuited for it the purer it is, since pure benzol forms a perfectly clear solution with the adulterant. Dr. de Vrij, who recommended this substance for the detection of gurjun oil in copaiba has probably used an impure benzol in his experiments.

Detection of Oil of Turpentine.—This, I believe, is the only volatile oil likely to be used for adulterating copaiba. Any large admixture with this oil is easily found out by the odour on heating the balsam. For the detection of smaller quantities I rely on the difference in the boiling points of oil of copaiba and oil of turpentine, that of the former being 240°–250° C., and that of the latter about 160°. In distilling a small quantity of oil from the suspected balsam, oil of turpentine passes over before the oil of copaiba, and can be recognised by its odour on heating the first few drops of the distilled oil on a watch-glass. In this way I have been able to detect $2\frac{1}{2}$ per cent. of the adulterant.

I trust that in future editions of our standard works tests for the purity of drugs which experience has proved to be fallacious will be omitted, as through their occurrence in such books they are invested with a certain amount of authority likely to mislead those who are wanting in personal experience of the subject. The recent prosecutions for an alleged adulteration of copaiba serve as a good illustration of the sublime faith which analysts ignorant of the nature and properties of drugs may have in the authority of books. It appears strange, too, that persons without a proper knowledge of drugs can hold appointments under an Adulteration of Food and Drugs Act.

The PRESIDENT said Mr. Siebold's remarks were very interesting and valuable, although the whole subject had been pretty well worked out twenty years ago by himself, and the results published in the *Pharmaceutical Journal*. Still the results then obtained, which entirely coincided with those found by Mr. Siebold, had been overlooked by writers on the subject, and tests which were then shown to be fallacious were still repeated. The result he then came to was that there was no test for the balsam which could be relied on, and that the only satisfactory mode of forming a judgment, was first to separate it into its proximate component parts and to test the resin and the oil individually. His method for the separation of the resin was not quite so simple as that mentioned by Mr. Siebold—evaporation in a watch-glass—because it comprehended not only the isolation of the resin, but also the collection of the oil. Dr. Muter's test had certainly the appearance at first sight of being a very good one, and he had used it on some occasions with advantage, but he agreed with Mr. Siebold that it could never be entirely relied upon, especially in indicating a specimen as being entirely free from adulteration. With regard to the use of benzol as given in the Pharmacopœia, it was introduced on the authority of a recent publication on the subject, and only referred to the adulteration with gurjun balsam. The whole subject was well worthy the attention of pharmacists, and at a time when they were liable to have the articles they dealt in called in question it was especially important that they should repudiate tests which could not be depended upon.

Mr. MANBY asked if Mr. Siebold would mention what he considered the best vehicle for the entire solution of copaiba, without deteriorating its medicinal qualities.

Mr. EKIN asked how Mr. Siebold assured himself that the samples he analysed were genuine.

Mr. UMNEY was pleased to hear it acknowledged that there was variation in copaiba balsam; in his experience there was no drug which varied so much. Only last week a large quantity of Para balsam was offered for sale which was as limpid as turpentine. As had been said by himself and others, the variation would be as much as from 20 to 60 per cent. of volatile oil, and 20 to 60 per cent. of resin. He had, however, never seen copaiba resin which was easily pulverizable, as Mr. Siebold stated. He had taken 30 to 40 lbs. from a still, fused it in a steam pan for six or seven hours, and found, even then, it refused to get brittle. He was not quite certain whether Mr. Siebold referred to benzol or benzoline when referring to Dr. Flükiger's test.

Mr. MOSS said that the limpid Para balsam was rarely to be found in the stock of the wholesale druggist, being used almost entirely for the distillation of the essential oil. He had not experienced the difficulty in using Flückiger's test for gurjun oil which had been referred to.

Mr. SIEBOLD, in reply, said benzol was a most excellent solvent for copaiba. He determined the genuineness of the sample by evaporating it on a watch-glass, to show the absence of fatty oil; the next process was to separate a little of the essential oil and convince himself by its odour, and, if necessary, by taking the boiling point, that it was oil of copaiba and not oil of turpentine. He then performed the test for gurjun oil; and not finding that, he was satisfied that the sample was pure, or at least free from all known adulterants. He had never met with an instance of adulteration with the oleo resin of *Hardwickia pinnata*. Probably the reason Mr. Umney had failed to obtain a brittle resin was because he had previously boiled it with water. If the water got into the interior of the resin, it never turned out satisfactorily; but if it was evaporated in a dish or watch-glass, a brittle resin was always obtained, and it was this form of test which he recommended.

Pure benzol was not a test for any impurity in copaiba, because it dissolved all known adulterants. Petroleum ether was very suitable for the detection of gurjun oil. In reply to Mr. Moss, he would add he did not say there was the slightest difficulty in detecting the presence of gurjun oil by Flückiger's test, if applied to the oil of copaiba. But if applied direct to the balsam, the test required some little practice to ensure correct results.

A vote of thanks was passed to Mr. Siebold, and the President stated that one of the samples he referred to as having been analysed by himself twenty years ago was still in the Museum of the Pharmaceutical Society, and side by side with it was a portion of the leaf, the sample having been collected by a member of the Society direct from the tree.

The next paper read was on—

A NEW MEDICINAL SOLUTION OF PHOSPHORUS.

By W. W. Urwick.

By the able paper Mr. Williams read on the administration of phosphorus, before the British Pharmaceutical Conference in 1874, giving a formula for the solution of phosphorus in glycerin and alcohol, and pointing out how a portion of the phosphorus became oxidized during the process, I was led to make one or two experiments with the desire to produce a formula not liable to change, for the administration of phosphorus in known doses and capable of administration without admixture if required. With this idea, I prepared phosphorus pills, and coated them with a solution of albumen; but after a time the pills ceased to be luminous on testing them, showing that phosphorus had disappeared and was no longer present in a free state. My friend Mr. Hampson has suggested that the albumen had become porous by drying. Though thus foiled, feeling I was on the right track, I turned my attention to making a solution that should be stable and contain known doses.

I adopted the suggestions made by Mr. Williams at the British Pharmaceutical Conference, with the following modifications:—I dissolved 2 grs. of phosphorus in absolute alcohol and glycerin at a temperature of about 170° Fahr, with the addition of a little cane sugar and sugar of milk, which addition, I have found, prevents any portion of the phosphorus passing into an acid state during the time of solution. When the solution is cold I add the albumen of one egg, first mixed with a little glycerin and alcohol, and then sufficient glycerin to measure 10 ounces; the strength of the finished product being one-fortieth of a grain to each dram, which I find to be quite strong enough to admit of its being preserved a long time without change, and taken, if required, without dilution.

I have kept some solution for more than two years without the phosphorus passing into the amorphous state, or the solution becoming acid or losing its luminous properties when mixed with water and agitated.

In no case as yet have I found any change, except where it had been, for the purpose of experiment, exposed to the strong rays of the sun, day by day, for a period of near three months, when a slight trace of amorphous phosphorus became visible. So thoroughly does the albumen protect the phosphorus, that when the solution has been mixed with water, and kept for a week, it still shows phosphorescence on agitation.

Though the foregoing may have little in it worthy of mention, one or two points have presented themselves to my notice which I deem may be of interest. Wishing to make the solution somewhat more agreeable to the palate, I added a few drops of oil of neroli to the albuminated solution of phosphorus; when, to my surprise, in an instant the solution lost its smell and flavour of phosphorus, and also its power of showing phosphorescence when mixed with water and agitated—indeed the phosphorus seemed at once blotted out of existence; but blue litmus remained unchanged, pointing out that it had not been oxidized. The question, "How does the oil of neroli prevent oxidation?" is a very interesting one, and one which I submit to the Conference. On this point, at present, I can give no satisfactory answer, but I found, on applying a strong heat to the solution with neroli, the peculiar ring-like fumes of phosphorus pentoxide formed. This may not be a crucial test, but points to the fact of the phosphorus being held in the solution with neroli in a free state. Yolk of egg deprives the solution of phosphorus of its luminosity, but still appears to hold the phosphorus in a free state. Indeed, the idea has occurred to me that the phosphorus natural to the egg occurs in the free state. Possibly it is the oily matter in yolk of egg that is the agent which absorbs the phosphorus from any solutions. On adding excess of the solution to the yolk, power of absorption is overcome and phosphorescence reappears.

Tincture of orange at once destroys the phosphorescence, smell, and flavour, as does also tincture of gentian. With tincture of calumba, and tincture of quassia, and tincture of nux vomica, the phosphorescence, smell, and flavour, remain unaltered.

Essence of lemon deprived the solution of its luminosity, but the smell and flavour remained in a modified form.

Oil of cloves also deprived the solution of its phosphorescence, smell, and flavour; but on agitation with water, and then standing, flashes of phosphorescence appeared at intervals, similar to electric sparks; and on keeping for two days the phosphorescence reappeared to a slight extent, but soon passed away.

With orange flower water the solution remains luminous nearly as long as it would with common water, retaining the smell and flavour of phosphorus. Milk destroys the phosphorescence, but the flavour and smell remain in a slightly modified state. Within this last week or two these points have presented themselves to my observation, but to the present time I have not been able to trace the chemical change, if any, that takes place in the phosphorus, or what combination it forms with essential oils or milk.

The formula referred to is:—

℞	Alcohol	1½ oz.
	Cane Sugar	½ oz.
	Sugar of Milk	¼ oz.
	Albumen of one egg,	
	Phosphorus	2 grs.
	Glycerin to	10 oz.

The PRESIDENT said the mode suggested for the solution of phosphorus was almost identical with one he had himself recommended, the principal difference being that he had suggested the mixture of oil and phosphorus with yolk of egg and water, which, with the addition of a little spirit of chloroform, made a mixture as palatable in his opinion as could be produced, and which would keep perfectly well without change for any reasonable time.

Mr. WILLIAMS said it was very interesting to find what an influence albumen and sugar appeared to have in preserving the phosphorus. The point of the paper was that the solution if examined with test paper was found to be in no way acid, proving that the phosphorus was not oxidized, but was really in its free state, which was not the case with most of the phosphorus solutions. The fact that some essential oils appeared to have the power of destroying the active condition of the phosphorus was an observation that deserved to be recorded.

Mr. Greenish said the one great objection to all these fluid preparations was, that when taken the eructations were so exceedingly disagreeable. He thought the pill of phosphorus in cacao butter less liable to this objection, and if to this a little Canada balsam were added the pill was made more plastic, and passed lower down the stomach before dissolving, so that the unpleasant sensations to which he had referred were avoided.

A vote of thanks was recorded to Mr. Urwick.

The next paper read was on—

ALBUMEN OF COMMERCE.

By Charles T. Kingzett, F.C.S.; and M. Zingler.

As is well known, albumen is largely employed for fixing certain colours on cotton goods, such colours, for instance, as madder-red and indigo-blue, which are almost the only fast colours possessed by dyers.

For fixing these and other colours egg albumen is well adapted, and would be without fault were it not for its high price. As it is, its use withdraws large numbers of eggs from the food market, and although blood albumen has to some extent taken its place in printing applications, yet this can only be employed for the inferior and darker colours.

It must be remembered that in printing, albumen serves a double purpose; it acts as a vehicle for the colour, and serves simultaneously as a varnish.

1008 eggs are said to yield* on an average six litres (1·3 gallons) of the whites in a fluid state, and four litres (·8 gallon) of the yolks. The white is evaporated upon zinc trays slightly greased with olive oil, and maintained at a temperature of about 30° to 35° C. The olive oil is used to prevent the adhesion of the albumen to the metal trays. In this way 14 per cent. of commercial albumen is obtained.

The evaporation is resorted to mainly because, as is well known, solutions of albumen very soon undergo putrefaction. But before use, the albumen has to be redissolved, and this is best done by adding it in a powdered state to water at 113° to 122° F. (45° to 50° C.), keeping the mixture well stirred to prevent agglutination of the albuminous particles. The water should never be added to the

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* "Handbook of Dyeing and Calico Printing." By W. Crookes, F.R.S.

albumen. The strength of the solution employed varies with the specific nature of the use; but on an average, a solution containing 300 grams to the litre is used, or nearly 3 lbs. to the gallon. It is necessary to filter such solution through a fine silk sieve, in order to absolutely free them from membranous tissue derived from the shells of the egg, otherwise the particles give rise to dark spots on the printed cloth. Egg albumen, prepared as described, is used for fixing the better colours and for all finer purposes, but its high price militates against its universal employment, commanding as it does from 4*s.* to 4*s.* 6*d.* per lb. (dry scales).

Blood albumen occurs in commerce in various forms,

The most inferior variety is packed in casks in the liquid state, and consists merely of blood which has been defibrinated by whipping. It is very dark red in colour, from the suspension of corpuscles, and soon putrefies, giving rise to stinking gases, which sometimes cause the casks actually to burst.

This same quality of blood albumen also occurs in the form of shining black scales, which on dissolving in water yield a cheap but dark coloured albumen solution.

The purer forms of blood albumen are prepared as follows:—The blood of slaughtered animals is collected in circular or square flat-bottomed and shallow basins with vertical sides. These are from 12 to 14 inches in diameter, and 4 inches in depth, containing about two gallons each. While standing in these vessels, during from two to six hours, the blood coagulates, and when this has happened, the clearer serum is run off into filters of a construction similar in form to the other vessels, but pierced with holes of about two inches in diameter, and lined with a dense cotton or linen cloth. The filtered liquor is allowed to subside during about twelve or fourteen hours, and the product is used for the lighter and brighter colours.

The clot is cut up and drained, and gives a further quantity of a somewhat darker albumen solution. To obtain the scales of commerce, these solutions are evaporated by a low steam heat, in thin films. The clot, consisting of the fibrin and corpuscles, is sold as a manure.

Five oxen, or twenty sheep, or thirty-four calves, are said to yield the same quantity of dry albumen, namely, 2 lbs. About 3*d.* is paid for the blood of each beast. Four gallons of blood, costing 10½*d.*, yield one gallon (or 25 per cent.) serum, costing 1*s.*; one gallon of serum yields fifteen ounces of dry albumen, of a quality which, at the present, is worth 1*s*. 2*d*. per lb. The price has rarely gone above 1*s*. 9*d*. per lb. It is thus seen that the market value of blood albumen barely covers the cost of production.

In producing blood albumen of commerce, the object to bear in mind, is the attainment of a substance whose solution is free from colour, possesses perfect coagulability, and which is cheap. On account of the superior price and value of egg albumen, it has for many years been a matter of desire to prepare a blood albumen of a similar whiteness and quality, and various attempts have been made in this direction. The only ones we need mention are as follows:—

Animal charcoal is sometimes used in order to remove the colour to some extent, but the precise method of using it is kept secret by manufacturers.

Incipient coagulation is also resorted to by others, a given small amount of coagulated albumen carrying down with it a considerable amount of colouring matter.

Air rendered ozonic by means of electric induction has also been employed, but the quantity of available ozone thus procurable is not nearly sufficient for the purpose, if the element of cost be at all taken into consideration. Again, it has been proposed to add peroxide of hydrogen to blood albumen solution; but this reagent is far too costly to be employed as ordinarily prepared. Another plan to which resort has been made, consists in adding turpentine and allowing the mixture to stand during some time with occasional stirring.

None of these plans are competent to produce an albumen at all comparable in value to egg albumen.

We now proceed to describe the process for which letters patent have been granted to us. It may be conducted upon blood itself, or defibrinated blood produced by whipping, or preferably upon the serum of blood prepared as described. When conducted upon the serum of blood, the product contains about 17 ounces albumen to the gallon, whereas, as already pointed out, the original serum contains about 15 ounces to the gallon; in other words, there is a considerable concentration. This solution is strong enough for many purposes, but for certain other purposes it should contain from 30 to 40 ounces to the gallon, and such a strength may be obtained by dissolving in the serum before treatment the requisite amount of commercial dried blood albumen.

In any case the solution to be treated is placed in a suitable apparatus, and to it is added about 5 per cent. of crude turpentine;

into the mixture maintained at about 30° to 60° C., a current of air is blown rapidly, the turpentine which is carried over as vapour being condensed by suitable means, and continually returned to the mixture. After a period varying (according to the quantity to be bleached) from two to ten hours, the operation is concluded, and all that remains to be done is to allow the product to settle, syphon off the albumen solution from any residual oil, and complete the operation by filtration through French grey paper. In this way an albumen solution is obtained which will keep well during the whole of the hottest summer, without the slightest decomposition, and which is as white as egg albumen.

We were led in the first place to this discovery by experimenting with the solution of "Sanitas," which is now being largely manufactured. It will be remembered that in a number of researches (a summary of which will be found in the *Society of Arts Journal*, Feb. 16, 1877) upon the oxidation of terpenes and allied hydrocarbons, one of us found that the aerial oxidation of turpentine resulted in the production of peroxide of hydrogen, camphor, camphoric acid, and other substances, which form the constituents of "Sanitas." This solution we found competent to bleach blood and blood albumen solution, but as the quantity which it was necessary to use was considerable, after-evaporation had to be employed to get the albumen of a strength suitable for its various applications. This method was therefore abandoned and the process above described resorted to, whereby the particular substances resulting from the oxidation of turpentine are produced *in situ*. In this way the albumen solutions are entirely bleached by the peroxide of hydrogen, while the camphor, camphoric acid, and other bodies simultaneously formed, exercise an antiseptic action, and preserve the albumen absolutely from decay and putrefaction.

We do not here propose to define the nature and function of an antiseptic or disinfectant; but taking an infectant to be that body which causes disease, and further accepting that which is ordinarily believed, viz., that disease is often caused by the putrefaction of albuminous principles, then we have in "Sanitas" a true antiseptic and disinfectant, for it absolutely prevents that putrefaction. It should be here stated that the presence of even traces of phenol is sufficient to almost entirely prevent the bleaching of blood albumen, either directly by "Sanitas" or by the oxidation process *in situ* already described.

The albumen solution prepared by our process is, in its general characters, analogous to ordinary forms of albumen. The coagulation which results on heating is, however, somewhat different; instead of being precipitated in flocks and flakes, it entirely gelatinizes. Moreover, when dried down, the albumen is not so soluble as the ordinary forms; this, however, is no objection, and indeed is an advantage, for there is no necessity to evaporate it down, keeping perfectly fresh as it does in solution; moreover, by its use some colours are better fixed than by the ordinary commercial albumen. Besides the use of our albumen in printing, there are various other applications of it, which we have also patented. For preparing photographic paper it appears to be admirably suited, while as a varnish, when used either alone or in conjunction with other bodies, as set forth in our specifications, for violins, pianofortes, and articles of furniture generally, it answers excellently, giving a beautiful gloss, and improving the *timbre* of musical instruments.

It admits of general use also for sizing and enamelling articles of wood, glass, or metal. For purposes of painting, the pigment is intermixed with the albumen solution and then applied in the ordinary way.

In pharmacy this albumen solution is extremely suitable for the precipitation of starchy matters in sarsaparilla and other decoctions, and of course possesses the advantage already stated, that it may be kept in a state of solution.

The cost of bleaching blood albumen by our process is but small, and is amply covered by the increased value of the product. It should also be stated that the above observations do not merely relate to laboratory experiments, but also to larger experiments and to the actual manufacture.

As regards the chemical changes involved in the bleaching process we have very little to say. It is well known that fibrin has the power of decomposing peroxide of hydrogen into water and nascent oxygen; ordinary albumen, however, lacks this power, although the rationale of the bleaching process is, no doubt, very similar, the colouring matter of the blood assimilating the second atom of oxygen from the hydric peroxide which is reduced to water. To hematocrystalline (or cruorine), which constitutes the colouring-matter of blood the formula $C_{600} H_{960} N_{154} Fe S_3 O_{177}$ is ordinarily assigned, with an atomic weight of 13,280. No matter what amount of doubt may be associated with the idea of such a chemical individual, the fact remains that blood crystals of hematocrystalline always contain four-tenths per cent. of iron. From hematocrystalline, hematine may be obtained with the formula $C_{32} H_{32} Fe_4 N O_6$,[*] and not unlikely it is this body which undergoes the oxidation under consideration, resulting in the bleaching of blood albumen solutions. Of the relative constitution of hematine nothing is known.

NOTE ON PILOCARPINE (FROM JABORANDI).

By C. T. Kingzett, F.C.S.

A few weeks ago Professor Attfield kindly gave me a few crystals of the nitrate of pilocarpine, and a few grains also of the platinic chloride salt. These I have since examined as follows:—

The crystals of nitrate were large and hard; when a little was burnt on a piece of platinum foil, it blackened, fused, emitted white inflammable vapours, and left a little ash. This fact, and the slightly yellow colour of the crystals, signified that the salt was not quite pure.

The rest was dissolved in water and aqueous solution of platinic chloride added, when the mixture went solid by formation of crystals. More water was added, and hydrochloric acid to decided acidity, and the solution thus obtained allowed to crystallize. Along with the crystals a little viscid uncrystallizable deposit was thrown down. The crystals were isolated, washed, and dried at 100° C.; there was only 0·125 gram when dry. It showed on analysis 24·8 per cent. platinum and 26·71 per cent. chlorine. (Relation 1: 6). I have shown in a previous publication[†] that pilocarpine has the formula $C_{23} H_{34} N_4 O_4$, and its dihydrochloride platinic chloride combination that of $C_{23} H_{34} N_4 O_4 2 H Cl Pt Cl_4$, requiring 23·4 per cent. platinum and 25·2 per cent. chlorine.

It would therefore appear (so far as could be ascertained from the extremely limited amount in my possession) that this salt prepared from the nitrate was identical with that I had previously analysed, but contained a slight excess of platinum chloride.

The platinum salt given me by Professor Attfield weighed 1·5 grams. This I distilled to dryness with an excess of pure caustic soda (made from the metal). The distillate was alkaline and had the odour of trimethylamine, whose reactions,[‡] so far as could be

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[*] Thudichum and Kingzett on hemine, hematine, and phosphorized substance present in blood corpuscles.—*Journ. Chem. Soc.*, September, 1876.

[†] *Journal of the Chemical Society*, October, 1876.

[‡] See paper by M. C. Vincent in *Bulletin de la Société Chimique de Paris*. No. 5. March 5, 1877.

determined, it gave; that is to say, it gave a very light blue precipitate with cupric sulphate insoluble in excess, and a faint precipitate with aqueous platinic chloride solution; both precipitates appeared soluble in boiling water.

It is, therefore, confirmed that (which I have previously demonstrated) jaborandi yields but one alkaloid, and it appears that this yields trimethylamine, as stated.

The PRESIDENT drew the attention of the Conference to some samples of nitrate of pilocarpine prepared by Mr Gerrard.

Mr. GERRARD said there was a great difference in the appearance of the crystals when produced from water and from alcohol. When the nitrate was boiled in alcohol it recrystallized on cooling in perfectly white crystals, but on a re-solution in water and recrystallization they had not that beautiful white crystalline appearance. One of the samples on the table had been recrystallized from water four times. He had tried many processes for the preparation of this alkaloid, but with a slight modification had returned to the one by which he first obtained it, exhaustion with ordinary spirit of wine, only that the spirit should be acidified with a little tartaric acid, an addition similar to that in Duquesnel's process for obtaining aconitine. The Société de Pharmacie had adopted a very similar process, except that it used chloroform, and the chloroform extract from the mother-liquor was shaken up with dilute hydrochloric acid. That however would not work well commercially; it was better to distil off the chloroform and work with the residue.

The thanks of the meeting were awarded to Mr. Kingzett for his two papers.

The last paper read was on—

EFFECTS OF VARIATIONS OF TEMPERATURE ON BOILED PUTRESCIBLE LIQUIDS.

By W. WILLMOTT.

The experiment which has been devised to solve the question of the possibility, or otherwise, of life being evolved from dead matter, is of a very comprehensive character. The question itself is of the deepest interest, not only to the scientific physician, but to the chemist, the physicist, and, perhaps, above all, the biologist. As a matter of speculative thought, it dates far back into the past, and as one of scientific investigation it has received the attention during many generations of "an almost unbroken succession of inquirers." Two hypotheses are held respecting it: "One, the germ theory, which declares that no life has ever been evolved (except in the remotest periods of the earth's history) otherwise than from a living parent or a living germ; the other, the spontaneous generation theory, which declares that now, as of old, life does also spring *de novo* from molecular rearrangements of the atoms of dead organic materials."

To test the truth of one or other of these hypotheses, we are told "there is absolutely nothing to be done but to take dead matter, isolate it from all contact with life, place it under favourable conditions for development, and watch the result;" and yet it is said, "this task has seemed to defy the efforts of as keen a body of inquirers as ever attacked any problem of nature."*

The method of experimentation almost uniformly adopted involves the employment of certain putrescible infusions, or other liquids in which bacterial life in its many forms is well known to appear in conjunction with any fermentation or putrefactive change which such liquids may be allowed to undergo. The behaviour of the freshly prepared fluid, after it has been submitted to a boiling heat and protected by one of many well-devised methods, from fresh sources of life in the surrounding atmosphere, is carefully noted. If bacteria† make their appearance it is conjectured that they must have arisen *de novo* from the supposed dead organic material of the infusion. The question is simple in statement, but, nevertheless, is beset with difficulties which are not unfrequently of an embarrassing character. Of the many eminent experimenters who have recently devoted their earnest attention to the subject, "by far the most conspicuous" is Professor Tyndall. He has gone over the ground so much in detail, and subpœnaed so curious a "cloud of witnesses," that some danger has been incurred of the investigation passing from the sublime to the ridiculous. In his laudable desire to grasp the whole truth, he has multiplied and repeated his experiments, with a great variety of putrescible substances, almost *ad infinitum*. Thus we find amongst the number operated upon, infusions of "mutton, beef, pork, hay, turnip, sole, haddock, cod-

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* *Vide* very able article by "Inquirer," in the April number of the *Contemporary Review*.

† "Bacteria" is a very convenient term, including numberless forms of animacules, belonging to the *Infusoria*.

fish. salmon, turbot, mullet, herring, eel, oyster, whiting, liver, kidney, hare, rabbit, barn-door fowl, pheasant, and grouse." And all this to show that putrescible fluids, when once sterilized and properly protected from the floating dust (*i.e.*, the germs) contained in the air, are incapable of spontaneously generating life in any form.

But Professor Tyndall's results are by no means unreservedly accepted, and the objection is entertained that he denies the conclusions of other investigators "mainly on the strength of his own unconfirmed experiments." It was this consideration which, in part, induced me to branch off from the inquiry I was some time since pursuing, to supply, so far as the means at my command would permit, a corroboration, or the reverse, of the Professor's ably achieved results. The introduction of an entirely different method of procedure might, as I thought, possess some value; whilst the experiments, if reduced to the utmost possible simplicity, would probably not be without their due weight in the balance. The *Pharmaceutical Journal* (Feb. 19, 1875) significantly refers to *temperature* as being an important consideration in this inquiry.* That it is so in the highest degree there cannot be a doubt, and indeed, without a due regard to this point, experiments are of little value as indicating perfectly reliable results. The three temperatures, or ranges of temperature, which I have chiefly employed for working out my conclusions, are the following: 130° to 160°, 90° to 110°, and 60° to 80°, all on the scale of Fahrenheit. At each of these ranges a different result is often obtained with the same infusion, and it is desirable, therefore, to connect them all closely with the inquiry.

With regard to the microscope, where such aid has been thought necessary, I have been fortunate enough to receive the assistance of a gentleman who for many years past has made microscopy his special study; and I am much indebted to him for the great service he has rendered me. The microscope, in this inquiry, is an all-important auxiliary, though in the majority of instances the unassisted eye will suffice to determine the question of life or no life.

I have spoken of numerous well-devised methods for the purpose of protecting or isolating the prepared fluid after it has been boiled a sufficient length of time. It matters little which of these methods is selected, provided the operation is adroitly performed;

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* "The range of temperature in Professor Tyndall's experiments was less than that directed by Dr. Bastian in the 'Beginnings of Life.' Whatever may be the actual value of this difference, it is unfortunate that it should have existed."

for when the fluid is completely sterilized they will all be found sufficiently perfect to keep it so. It is quite probable, if indeed there is any difference at all in their value, that, by a sort of paradox, the worst may be the best, since if the fluid is *not* sterilized, its condition of vitality will be thereby the more readily manifested. This, then, is one of the chief points to be determined. Is the liquid, after experiment, completely sterilized, or only partially so? Much misconception has, I think, arisen from an insufficient consideration of this particular feature in the inquiry.

After a number of experiments with cotton wool, an old but efficient medium in completely arresting germs and ultra-microscopic particles, I found that in the apartment in which I was working, my specimens were by this process completely preserved; but on submitting others similarly prepared to a high incubating temperature, viz., 90° to 110° F., they broke down without exception, in a very decided manner. I may state here that, at this temperature, protected infusions which are not sterilized usually begin to change within twelve hours, and whenever they are found intact at the close of the third day, almost invariably remain so for an indefinite period of time. Many of my specimens protected with wool have evaporated to an extract without the slightest putrescent change.

On seeing the effect of the higher temperature on the prepared infusions, I was in doubt as to the power of the cotton wool sufficiently to filter the air; but on substituting pear-shaped flasks for the form of vessel I was using, the effect was entirely reversed. All the infusions remained sound, and there was not a single delinquent amongst them. From pear-shaped flasks I soon passed to conveniently shaped bottles; for I had no intention of departing from the plan, which I had from the first adopted, of boiling the liquids in an open vessel of a suitable construction. Later on, I employed tinfoil almost entirely in the place of cotton wool, finding its preparation for the purpose intended far more rapid and convenient.*

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* To make this material secure, as it is apt to be perforated with minute pin holes, a sheet of tinfoil is brushed over with a thin coating of mastic varnish. On this is laid a covering of waxed paper, and another sheet of varnished foil being then placed smoothly on the paper, the whole is introduced into a powerful press, and by this means firmly united together. The sheets thus prepared are as impervious to the atmosphere as glass itself. The precaution is not really necessary if the foil be used doubled, but its adoption will serve to dispel all

Thus my process was extremely simple, and I think wholly to be depended upon when carefully performed.

I had experimented in this way on hay, gentian, calumba, and also turnip. The next substance to be dealt with was cucumber. This was one of the most refractory of all Professor Tyndall's "witnesses," because of its great proneness to decomposition. I took, therefore, unusual care in preparing the specimens, using glass stoppers and cotton wool as protecting media, the former having been specially made for me with tapering points, so as to admit of their introduction into the neck of the bottle without even the smallest modicum of air.* Though one minute only was allowed as the time of boiling, the specimens remained perfectly pellucid, and without the slightest indication of change. It is fair to say that magnesium carbonate, and not potash, was here used as the neutralizing agent; and this I subsequently found to be a method of treatment to which cucumber is in a very marked degree amenable.

From this point I passed on to *old* hay, and soon encountered my first real difficulty. There could be no mistake about *the age* of the sample (1874) I was fortunate enough to secure. It will be remembered that it was *old* hay which caused such an infinity of trouble at the Royal Institution, and so infected the atmosphere with its germs that it was only by "the gradual but irresistible interaction of thought and experiment" that the true cause of the many failures experienced was at length brought to light. In dealing with this substance, therefore, I was specially careful to avoid accidental error in isolating the specimens. Several of these, prepared with slight differences, were placed in the usual temperature, and all broke down within twenty-four hours. The same thing was repeated with additional precautions, and again every specimen broke down. I now became very much interested in the old hay, and my next plan of procedure was to submit it to the vapour of a powerful germicide for twenty-four hours; but this proved of no avail, the infusions broke down as badly as before. I then tried

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doubt. Though this process does not admit of a complete vacuum between the surface of the liquid and the tinfoil, the air is quite sufficiently excluded to render it in this respect entirely free from objection. The danger resides more in the liquid itself than in the air above it.

* It is well known that at ordinary temperatures boiled infusions may be perfectly preserved by means of glass stoppers.

careful filtration through various media. This effected some good, but was not entirely successful. The hay was next subjected, in its dry condition, to a high temperature for several days. There was evidently an improvement after this, though bacteria still continued to put in an appearance. What then was to be done? Long periods of boiling were not to be thought of, but if an agent could be found which would suspend putrefaction in the liquid, and yet entirely pass off without any change, the germs might, in due time, become "softened," and the five minutes' boiling accomplish the rest. Such an agent was to be found in chloroform. Chloroform is one of the most perfect antiseptics we possess, but it does not kill the germs or destroy the putrescent tendency of the infusion. Accordingly, a suitable quantity of the latter, containing two minims of chloroform to each fluid ounce, was prepared and placed in the incubating temperature for a week. It was, of course, at the end of that time in perfect condition; a small portion protected with wool gave way as soon as the chloroform had passed out of the fluid, showing that the infusion was not changed in any way. Protected specimens of this preparation were tried as before, but altogether without success. The theory of *softening*, even in a warm temperature, received no illustration or countenance from this experiment, so that the question forces itself upon the mind, Is it a particulate germ at all which causes putrefaction? If so, it must be of remarkable tenacity, since it may be asphyxiated indefinitely by the chloroform without being softened in the slightest degree by the heated fluid.

How, then, was the old hay conquered? The infusion was boiled for one minute and placed in a *continuous* temperature ranging from 130° to 160° Fahr. At the end of a week it was removed, and the whole thing was accomplished. As the organisms became developed, or, in fact, before this occurred, they were summarily disposed of by the heat, the infusion being thereby left in a permanently pellucid condition.

But after this success, I found on further trial with other substances, that my previous results were not again obtainable. This was precisely an analogous case to that of the Royal Institution. I commenced, therefore, a systematic attempt better to understand the conditions which governed these erratic changes. A great deal had been said about *potash*. What was the real part played by this substance in the production of the observed results? The experiments as shown in the following table gave me the answer:—

Infusion.	Time of Boiling.	Quantity of Liq. Pot. to ℥j.	Reaction.	Temp.	Result.
Cucumber.	1 min.	None.	Acid	95° to 110° F.	Broke down within 48 hours.
,,	,,	♏ j.	Neutral	,,	Do.
,,	,,	,, ij.	Alkaline	,,	Do.
,,	,,	,, iij.	,,	,,	Broke down within three days.
,,	,,	,, v.	,,	,,	Intact.
,,	,,	,, x.	,,	,,	Do.
,,	5 min.	None	Acid	,,	Broke down within 48 hours.
,,	,,	♏ j.	Neutral	,,	Do.
,,	,,	,, ij.	Alkaline	,,	Do.
,,	,,	,, iij.	,,	,,	Broke down within three days.
,,	,,	,, v.	,,	,,	Intact.
,,	,,	,, x.	,,	,,	Do.
,,	10 min.	None	Acid	,,	Broke down within three days.
,,	,,	♏ j.	Neutral	,,	Do.
,,	,,	,, ij.	Alkaline	,,	Intact.*
,,	,,	,, iij.	,,	,,	Broke down within three days.
,,	,,	,, v.	,,	,,	Intact.
,,	,,	,, x.	,,	,,	Do.
,,	15 min.	None	Acid	,,	Broke down within three days.
,,	,,	♏ j.	Neutral	,,	Do.
,,	,,	,, ij.	Alkaline	,,	Do.
,,	,,	,, iij.	,,	,,	Do.
,,	,,	,, v.	,,	,,	Intact.
,,	,,	,, x.	,,	,,	Do.
,,	½ hour	None	Acid	,,	Broke down within three days.
,,	,,	♏ j.	Neutral	,,	Intact.
,,	,,	,, ij.	Alkaline	,,	Do.
,,	,,	,, iij.	,,	,,	Do.
,,	1 hour.	None	Acid	,,	Intact.
,,	,,	♏ j.	Neutral	,,	Do.
,,	,,	,, ij.	Alkaline	,,	Do.
,,	,,	,, iij.	,,	,,	Do.

Here, then, seems to be revealed the whole secret of the potash. If the fluid is completely sterilized, it is perfectly immaterial how much or how little potash is added. On the other hand, if the potash is added in sufficient quantity to prevent the fluid from becoming acid, it is of no consequence whether it is sterilized or not. The action is perfectly consistent throughout. The potash simply plays the part of an efficient antiseptic. Like all substances of this

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* Contradictory result.

class, the effect it produces bears an exact relation to the quantity used.

The following table shows the wide difference in effect between a temperature of 70° F. and 100° F., in relation to bacterial development:—

No. 1. TEMPERATURE, 70° Fahr.

Infusion.	Time of Boiling.	Result.
Turnip.	1 minute	Slightly cloudy.
,,	2 ,,	Clear and pellucid after a month.
,,	3 ,,	Do. do.
,,	4 ,,	Do. do.
,,	5 ,,	Do. do.

No. 2. TEMPERATURE, 100° Fahr.

Infusion.	Time of Boiling.	Result.
Turnip.	1 minute	Broke down within forty-eight hours.
,,	2 ,,	Do. do.
,,	3 ,,	Do. do.
,,	4 ,,	Do. do.
,,	5 ,,	Do. do.
,,	6 ,,	Do. do.
,,	7 ,,	Do. do.
,,	8 ,,	Do. do.
,,	9 ,,	Do. do.
,,	10 ,,	Remained intact.

The above seems to show that error may be caused by concluding that an infusion is sterilized because it remains pure at certain temperatures. Unless protected infusions are submitted to a temperature of 100° to 110° F., they can scarcely be said to have undergone the severest test of their assumed sterilized condition.

We now return for a moment to the old hay. In order definitely to test the question of infection of the air by hay particles or germs, Professor Tyndall had a shed erected on the roof of the Royal Institution. In this shed infusions were prepared precisely as before, but the experiment, we are told, resulted in complete failure.* The shed was then disinfected, the infusions were again prepared, suitable clothes were worn, and "the result was similar to that obtained

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* See *Nature*, June 14th, 1877, p. 127.

at Kew, viz., organic liquids, which in the laboratory withstood two hundred minutes' boiling, were rendered permanently barren by five minutes' boiling in the shed." A rod thirty feet in length would stretch from the infusions in the shed to similar infusions in the laboratory. "Either," says the Professor, "we infer that at one end of the rod animal and vegetable infusions possess a generative power which at the other end they do not possess; or we are driven to the conclusion that at the one end of the rod we have infected and at the other end disinfected air." I cannot say that I am prepared to accept unreservedly either of these inferences. The professor had at one end of the rod a powerful weapon which he did not possess at the other, namely, carbolic acid. Carbolic acid is not only a disinfectant, it is a powerful antiseptic. Organic liquids placed sufficiently long in the vapour of this antiseptic would absorb it and thus become preserved. To test this I made a somewhat similar experiment. The floor and walls of a small room a few yards distant from the laboratory were well washed with a 2 per cent. solution of carbolic acid, the odour of which was perceptible in the air of the room for several days. In a small box or chamber, protected by cotton wool, were placed tubes of cucumber and turnip infusion, the whole being left in the room charged with the carbolic vapour. In six days the tubes were removed from the box, and it was quite evident, from their sound condition, as well as from their subsequent behaviour, that sufficient acid had been absorbed to render it highly probable that, under favourable circumstances, a condition of permanent stability would be thereby imparted to them. I do not offer the foregoing as an explanation of the wide difference experienced at the two ends of the hypothetical rod, but simply as a third inference arising out of the circumstances of this particular experiment. Whether in my own case, the hay dust was capable of infecting the air and contaminating the infusions I was preparing, it was my special care to determine by actual experiment. Taking, on several occasions, cucumber and turnip infusions of a strength known to be sterilized by five minutes' boiling, I placed them in wide open vessels in a confined space in which old hay had previously been shaken. After twelve hours they were boiled and protected in the usual way, and almost uniformly foreign organisms were developed. I now applied the same process to a fair sized room. Hay was tossed and shaken in this room until there was a perfect haze of dust. The next day nothing could be seen of this dust in the air, but it had not all fallen. Infusions were prepared in the room and clearly developed the organisms, though not so extensively as in the former experiment; indeed, one specimen which was not submitted to the high temperature, remained free from all signs of life. Where this infection ends it is not easy to say; but I am disposed to think it does not extend very far. Infusions prepared in the same room a day or two later became very slightly cloudy, but otherwise remained intact, though the same dusty garment was worn by the operator. Nor does this hay infection appear to resist determined treatment. Twenty minutes' boiling, or very careful filtration specially conducted, will destroy or remove the "plague" if it has not removed itself by falling to the ground. This I give as my experience.

There can be no doubt that many circumstances combine to influence the erratic and often unaccountable behaviour of these vegetable organic fluids. Among them may be enumerated the following:—(1) Condition and age of the substance employed; (2) strength of infusion; (3) method of filtration; (4) isolation, or exposure to the sun's rays; (5) chemical constitution; (6) time and manner of boiling; (7) temperature previous to protection; (8) temperature after protection; (9) method of isolation; and (10) completeness in the performance of the process involved. We have already referred to the *strength* of infusions as influencing their sterilization, and amongst the causes enumerated above this is a very prominent factor. Five minutes' boiling will usually be found sufficient if the strength is regulated accordingly. I give the following as proportions from which, *cæteris paribus*, something approaching uniform results may be looked for:—

Infusion.	Strength employed.	Time of Boiling.	Temperature.	Result.
Cucumber	ʒij. in ℥j.	5 minutes	90° to 110° F.	Breaks down.
,,	ʒj. ,, ℥j.	,,	,,	Remains intact.
,,	ʒss. ,, ℥j.	,,	,,	,,
Turnip	℥j. ,, ℥j.	,,	,,	,,
,,	℥ss. ,, ℥j.	,,	,,	,,
,,	ʒij. ,, ℥j.	,,	,,	,,
Old Hay	1 oz. ,, Oj.	,,	,,	Breaks down.
,,	½ oz. ,, Oj.	,,	,,	Remains intact.
,,	¼ oz. ,, Oj.	,,	,,	,,

If, on the other hand, we take strong or refractory infusions, and direct our attention to the time of boiling required to sterilize them, we may regard the following as starting points from which we may branch off into more exact experiment:—

Infusion.	Relative proportions as protected.	Temperature.	Time of Boiling required for sterilization.
Cucumber . .	1 oz. to 1 fl. oz.	95° to 110° F.	Within ½ hour.
Turnip . . .	1 oz. „ 1 fl. oz.	„	„ 10 minutes.
Old Hay . . .	4 oz. „ Oj.	„	„ ½ hour.
Cucumber charged with old hay dust .	½ dr. „ 1 fl. oz.	„	„ 20 minutes.

We may observe that particularly strong infusions are sometimes sterilized with greater facility and in less time than those prepared in a weaker form. A good example of this is turnip, which when prepared in the above proportions may usually be sterlized without difficulty by five minutes' boiling; and this, moreover, even if prepared in an atmosphere charged with hay dust, provided the filtration be conducted away from the compartment so infected. The reason is that the particulate matter is very perfectly retained by the pulp, leaving a brilliantly clear liquid, which is especially free from motes and ferments of a solid character.* Thus we may, by repeated and continuous experiment, reduce all this apparent contradiction to something like law and order. At present the operator is puzzled beyond measure by the erratic behaviour of his prepared fluids under varying circumstances of a scarcely appreciable character, from causes which he can neither see nor grasp. But one thing seems clear. A putrescible infusion in which the ferment has once been destroyed by heat, is deprived of the ability to undergo in itself those chemical changes with which low forms of life are so abundantly associated.

Before leaving the class of experiments which have received such marked attention from Professor Tyndall, we note that, referring to the germs of old hay, he remarks with very laudable concern, "It is a question of obvious interest to the scientific surgeon whether those powerfully resistant germs are amenable to the ordinary processes of disinfection. How would they behave in the wards of a hospital?" This, I think, is not a difficult question to answer. They would behave very much as they behaved in the Professor's own shed, that is, they would be rendered harmless by the disinfectant

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* The effect of filtration through various media on putrescible fluids is a subject for further experiment. Would porous porcelain arrest and retain *all* particulate matter in a translucent and freshly prepared organic liquid; and would the ferment, whether particulate or not, be capable of being so retained?

if it happened to be present in any appreciable quantity. To illustrate this, the following experiment was made :—Old hay was cut very fine and introduced into two separate wide-mouthed bottles. The bottles were then shaken so that the dust from the hay, in quite a cloud, might completely fill them. Infusions boiled one minute only were introduced into the midst of the dust in open vessels resting on the solid hay. In each bottle was placed a small quantity of cotton wool moistened in one case with carbolic, and in the other with sulphurous acid, so that the vapour might distribute itself through the fine particles of dust which were, of course, fast falling into the infusions. Let us suppose the bottle to be the ward, the infusion the susceptible patient, and the dust-laden air the medium though which the disinfectant was distributing itself and exerting its influence. Now, did the infusions change and putrefy, or did they not? They did not; and they remain in each case clear and translucent to the present day; not because the desiccated germs were destroyed by the disinfectant, but because the penetrating vapours were absorbed by the liquids and exerted their antiseptic properties. Disinfectants are not all antiseptics, and *vice versâ*, but here they combine the two effects. The favourable conditions, however, of this experiment could not be secured in a hospital ward, since they would be interfered with by the currents of air passing through the ward from the open doors and windows; but the good to be derived from carbolic acid *dressings* is already achieved to the fullest extent.

Speaking purely from a chemical point of view, it is a question for the scientific surgeon whether obstinate and fœtid wounds would not heal rapidly in a high and antiseptic temperature, such as 130° F., where no putrefactive change ordinarily so called can go on, provided always it be possible to subject the patient, or the wound itself, to its continuous influence. The clear, smooth, and healthy surfaces of men who are constantly in the "calidarium" seem to point to good, rather than harm, from such an ordeal; and we all know the extraordinary adaptability of the human system to changes of a severe character when gradually introduced.

We now pass to "turnip and cheese." Turnip and cheese! That it should be necessary to introduce such substances into a scientific discussion! "Oh, the pity of it, Iago, the pity of it!" But thus it is, for we have here a highly nitrogenous compound exceedingly prone to decomposition. Of turnip and cheese it is said, "it is established beyond dispute that a turnip infusion, with cheese dust added, will produce life after having been boiled and protected from contact with the atmosphere or anything it may contain." This is perfectly true; but as we have seen that all these things are apt to differ in their power of resisting a boiling temperature, the value of the statement from its indefiniteness on this point is clearly detracted from. "After having been boiled." True, but how long boiled? This is important, because amongst the compounds which seem to favour the theory of spontaneous generation, this one of turnip and cheese holds a very prominent place. Cheese *dust* is the substance mentioned; but whilst the dry powder was managed without any great difficulty, moist cheese was found to be very intractable. The latter was mixed in the proportion of 10 grs. to each fl. oz. of turnip infusion. The mixture was boiled five minutes and then carefully filtered. The filtrate was opalescent and charged with casein. When this was boiled and placed as usual in the incubating temperature it could not be preserved; but on the addition of liq. potassæ, q. s., to prevent the separation of the casein, or to hold it in solution, there was no apparent change. Here, again, we have the potash showing itself antagonistic to germ life and development. Ultimately this obstinate mixture of turnip and cheese was successfully dealt with—as in the case of the old hay—by placing it in the extreme high temperature (130° to 160° F.) for six days. When removed it was found free from change, having acquired a condition of permanent barrenness.

We have, lastly, to deal with a fluid which has very recently been the subject of dispute between Dr. Bastian and M. Pasteur. The fluid in question, viz., urine, is a highly complex chemical compound, and, therefore, imparts to the inquiry a purely physico-chemical character. The difference between the two philosophers named has reference to the production of life in this fluid after it has been boiled and neutralized with potash. The former asserts that under such circumstances "swarms of bacteria" are invariably generated in it; whilst the latter, M. Pasteur, emphatically denies this, conditionally upon the potash having been previously heated for a few minutes to 110° C. to destroy the germs which he states are introduced with it. The arrangement for the experiment has been very ingeniously devised. The potash is heated to the required degree in a small sealed tube which is then introduced into the flask containing the fluid to be boiled. After the boiling (the time unfortunately is not specified) and sealing of the flask hermetically, the tube is broken and its contents mingling with the acid fluid, renders it about neutral, in which condition it has been found by one experimenter very fruitful, and by the other altogether barren. The difference is made to turn upon the potash, as to whether it has been heated sufficiently to destroy the supposed germs which it is said to contain. But I hold from what I have observed in reproducing this experiment, that the potash plays a negative part only. The fluid is kept from undergoing decomposition by the free acid it contains. When this is removed by the potash, always in certain relative proportions to it, its antiseptic effect is removed also, and the fluid is free to undergo the putrefactive change, either if it is capable of generating life anew, or if the germs which it previously contained have not been destroyed by the boiling process. This view of the case is borne out by the fact that too much or too little potash will interfere with the result and prove fatal to the production of life. In the former case the potash itself will be the antiseptic; and in the latter the acid will still be present in sufficient quantity to retain its effect. Here, again, we see that the question becomes one of *quantity*, supposing either of the above conditions (spontaneity of generation, or non-destruction of germs) to be present in the liquid. But now let us ask a question upon which we have already laid great stress, viz., when the potash is added to the cooled fluid, is the latter sterilized or is it not? The fact that the fluid remains barren before the addition of the potash, even if the latter be delayed for weeks, is no proof whatever of its being in a sterilized condition, since the free acid is there to preserve it from change and prevent it from becoming fertile. That it is of a very refractory character and very resistant to heat seems from experiment abundantly clear. When exactly neutralized with liq. potassæ, and boiled for five minutes, the alkali, to a greater or less extent, is dissipated, and the acid reaction becomes re-established. The fluid is also turbid from the deposition of earthy phosphates. Therefore, to secure a bright and neutral liquid we proceed as follows. Three separate boilings are often sufficient, but we give an instance of five:—

	1.	
Filter and neutralize with ♏ xj. liq. pot. to ℥j.	Boil 5 minutes.	Result. Turbid. Acid to test paper.
	2.	
Re-filter and neutralize with ♏ v. liq. pot. to ℥j.	Boil 5 minutes.	Result. Turbid. Acid to test paper.
	3.	
Re-filter and neutralize with ♏ iv. liq. pot. to ℥j.	Boil 5 minutes.	Result. Turbid. Acid to test paper.

4.

Re-filter and neutralize with ♏ iiiss. liq. pot. to ℥j.	Boil 5 minutes.	Result. Bright. Very slightly acid to test paper.

5.

Neutralize with ♏ j. liq. pot. to ℥j.	Boil and protect.	Result. Negative at 120° and upwards, and at 60° to 80°; but positive at 90° to 110°.

The result here shown is exceedingly instructive. Life is manifested at the medium temperature, but fails to appear at 70° and 120°, thus illustrating in a marked manner the importance of a few degrees of heat more or less in influencing the result. At 120° F. and above, all my results were negative. The changes were purely of a chemical character. Earthy phosphates and triple crystalline deposits were thrown down in the presence of the potash by the action of the heat, as in the case of boiling, all being freely soluble in nitric and hydrochloric acids. At the same time ammonia was rapidly generated from the breaking up of the urea. The formation of ammonia is usually associated with putridity. Putridity, in a sense not generally so understood, may here be present, but it is unaccompanied by vibriones, or bacterial life of any kind. This phenomenon has not, that I am aware of, been noticed by any writer on the subject. To show the resistant power to sterilization of this organic fluid, it may be stated that a specimen boiled for twenty minutes and neutralized, as already shown, was submitted to 150° F. for about 72 hours, then again boiled and protected and placed in the incubating temperature. Yet, notwithstanding this, it gave distinct evidence of life within the usual three days. It is clear, therefore, that to render urine completely barren it requires very prolonged and active treatment. Nor must it be forgotten that it is only when the potash is added in certain definite proportions that bacteria make their appearance. The reason of this, as before intimated, is sufficiently obvious. The free acid and the alkali are both antiseptics. Should either predominate over the other in sufficient quantity to exercise its antiseptic action, the result will be negative. On the other hand, if this action has been nullified in each instance by proper proportionate quantities the reverse will be the case, *i.e.*, *if the fluid remains in an unsterilized condition.* It will be seen that in carrying out this experiment, except by the thoroughly experienced expert, at least six flasks should be taken containing the potash in different proportions to the ounce, from five minims up to fifteen. The correct quantity will then be secured; for normal urine differs very widely in the amount of acid it contains. Exact neutralization, or a little below it, is the condition to be aimed at. Under such circumstances we get results similar to the following:—

BOILED FIVE MINUTES.

Liq. Potass. to each ʒj.	Temperature.	Result.
v. ♏	100° to 115° F.	— *
vij. ,,	,,	— *
ix. ,,	,,	+ φ
xj. ,,	,,	+ φ
xiij. ,,	,,	+ φ
xv. ,,	,,	— *

BOILED ONE HOUR.

Liq. Potass. to each ʒj.	Temperature.	Result.
ix. ♏	100° to 115° F.	— *
x. ,,	,,	— *
xj. ,,	,,	+ φ
xij. ,,	,,	+ φ
xiij. ,,	,,	— *
xiv. ,,	,,	+ φ

* — Negative, indicating no change.
φ + Positive, showing development of life.

It will be observed, that in each of the above experiments (boiling respectively for five minutes and one hour) three flasks broke down, whilst three remained intact. This singular outcome was no doubt entirely due to the relations between the acid and the alkali present in the unsterilized fluid. How long it would be necessary to continue the boiling to secure entire immunity from these "break downs," if such a result is to be accomplished at all, I am not prepared to say; but if life can be detected after eight hours' boiling in the case of old hay infusion, we may, perhaps, fare but little better in the present instance. Nor is it at all necessary to determine this; for we fall back upon our infallible treatment, and all ambiguity disappears. The result is slowly and unobtrusively, but yet decisively, worked out for us. Six days quietly devoted to the destruction of the germs at the bacterial death point will set the question completely at rest. We shall have our earthy phosphates deposited by the action of the heat; but no matter. Physics and chemistry may step in to alter and rearrange, but the question is, Can life be generated *de novo* in any fluid which is, in reality, the dead organic matter we are necessarily required to secure? And this can only be answered by having the absolute assurance that it *is* this *dead matter* from and out of which the new life comes actively into being.

The outcome of all this will no doubt have been anticipated. I propose, in fact, to do away with boiling as a means of sterilization, and substitute continuous heating at a lower point on the scale. We shall thus do away with all complication and liability to "grave error," and reduce the test to one of extreme simplicity. For the moment, we lay aside flasks, boxes, chambers, retorts, bulbs, tubes, *et hoc genus omne*, and call to our aid accurately fitted stoppered bottles. Robbins' 4-oz. anhydrous ethers answer admirably. The prepared fluid is boiled for one or more minutes where the decomposition is usually found to be rapid, and then introduced into the phial to about two-thirds of its capacity. The air space is left, to allow of subsequent expansion in the case of unboiled liquids. Having introduced the stopper and secured it firmly in its place, the phial is labelled and placed immediately with its contents in an atmosphere heated to 150° Fahr., or above. There it is left, the heat being continuously maintained. The exact time which should intervene in each case to secure subsequent immunity from change must be determined by experiment. To make assurance doubly sure, I have usually allowed six days for the operation, and not in any single instance, after the lapse of that time, have I observed the slightest indication of bacterial development. Thus, I have infusions of gentian and calumba, old hay, new hay, turnip, cucumber, beef, turnip with cheese, and the test-fluid referred to, with and without potash, all perfectly sound and translucent, and apparently in a condition of permanent barrenness. If we have any affection for hermetically sealed flasks and glass bulbs, we may prepare these in the usual way and substitute the comparatively low but continuous temperature for our lamps and oil-baths. The experiment is entirely novel and something more. It is, so far as I have carried it out, *conclusive* as to the point at issue. With great earnestness and ability, Dr. Bastian has made clear to us the degree of heat in which all bacterial life is extinguished.* It follows as an irresistible conclusion, that if this heat be sufficiently prolonged, the most indurated and resistant germ will ultimately succumb and cease to be. If,

---

* 158° Fahr., Bastian (moist heat). 300° Fahr., Dallinger (dry heat).

at this point, life cannot be reinstated without contact with fresh sources of vitality, we may, perhaps, be permitted to say of spontaneous generation, as Macbeth said of his immortal dagger, "There's no such thing!" My experiments irresistibly tend in this direction, and as they are extremely simple they may be gone over and verified by all who have the requisite technical knowledge for conducting the processes involved. The result will probably be shadowed forth to them in the old Latin proverb, *E nihilo nil fit.*

In conclusion, it will be readily understood that in this investigation there is a great deal behind the scenes, both of failure and success, of hard, profitless, and yet encouraging work, which must necessarily remain unrecorded. But most assuredly in this, as in all physical and chemical research, the results will be accurate and reliable in proportion as the means selected for their achievement are zealously worked out and adequately and impartially fulfilled.

The PRESIDENT thought Mr. Willmott had thrown some new light on the subject, indicating that time was an element in the application of heat to destroy the vitality of low forms of life.

Mr. KINGZETT, having followed the discussion on this subject fairly well, could see nothing new in the paper which had been read. The dead lock in the controversy depended on what had been discovered by Mr. Dallinger, namely, that although the heat employed by Dr. Bastian or Professor Tyndall might be sufficient to kill germs, it was totally insufficient to kill spores. He did not see how Mr. Willmott's method would affect this question.

Mr. WILLMOTT said he had the pleasure of hearing the lecture given at the Royal Institution by the Rev. Mr. Dallinger, who stated that he found germs or spores of bacteria were killed only at a temperature of 300° by dry heat, and also gave a description of the mode in which he experimented. His (Mr. Willmott's) method was totally different. The germs or spores, for he did not refer to developed bacteria, were not submitted to dry heat but to moist heat, and Dr. Bastian had correctly pointed out that the temperature necessary to destroy the germs or spores of bacteria in a *moist* heat was 158°. The method of keeping up the heat to this point for a length of time, not boiling at all, except (in some instances) for one or two seconds, was perfectly new.

The PRESIDENT in moving a vote of thanks to Mr. Willmott said this concluded the list of papers.

Professor Attfield read a list of names of gentlemen desiring to become members, who were elected unanimously.

Place of Meeting in 1878.

Professor Attfield then moved that the Conference meet next year in Dublin, on the two days immediately preceding the meeting of the British Association. He said he had had a communication from the Secretary of the Pharmaceutical Society of Ireland, enclosing a resolution to the effect that the Council of the Society desired that the Conference should meet in Dublin next year. He had also had many letters from leading pharmacists in Ireland expressive of the same desire. And he thought that the representative members of the Conference were in favour of meeting in Dublin in 1878.

Mr. Williams seconded the motion. He did so with all the more pleasure because when the British Association met in Belfast there were reasons which prevented the members of the Conference visiting their friends in Ireland; but things were altered now, and he had no doubt they would have a pleasant and profitable meeting.

Mr. Payne (Belfast) was very sorry to find he was the only member of the Conference present from Ireland; but he thought probably the days on which the meetings were held had something to do with it, being rather inconvenient for the Steam Packet Service. Professor Tichborne had been thus prevented arriving in time to give a formal invitation from Dublin; but he could assure the Conference that the Irish pharmacists would do all they could to give their English friends a hearty welcome.

The resolution was carried unanimously.

Election of Officers.

The following officers were then elected for the ensuing year:—

President.

G. F. Schacht, F.C.S., Clifton.

Vice-Presidents.

R. W. Pring, L.A.H.D., Belfast.
R. Reynolds, F.C.S., Leeds.
Professor Tichborne, F.C.S., Dublin.
J. Williams, F.C.S., London.

Treasurer.

C. Ekin, F.C.S., Bath.

General Secretaries.

Professor Attfield, F.C.S., London.
F. Baden Benger, F.C.S., Manchester.

Local Secretary.

W. Hayes, Dublin.

Other Members of Executive Committee.

A. P. Balkwill, Plymouth.
M. Carteighe, F.C.S., London.
H. N. Draper, F.C.S., Dublin.
J. T. Holmes, Dublin.
B. S. Proctor, Newcastle-on-Tyne.
E. Smith, F.C.S., Torquay.
J. C. Thresh, F.C.S., Buxton.
W. A. Tilden, D.Sc., F.C.S., Clifton.
C. Umney, F.C.S., London.

Auditors.

S. B. Turney, Plymouth.
W. Allen, Dublin.

Mr. Schacht said he very much appreciated the honour done him in electing him President. It would be affectation not to say that he had looked forward to the possibility of some day occupying this distinguished position, and at a distance the fact did not look very alarming; but when it came closer the difficulties appeared in a stronger light, especially as he had to follow Dr. Redwood's very able presidency. However, he could only throw himself on the indulgence of the gentlemen who attended the Conference, with a promise to do his best.

Mr. Schacht again rose to propose a vote of thanks to the Local Committee who had exerted themselves so much to make the meeting pass off well, and were on the morrow intending to do still more in the same direction in connection with the more social aspect of their gatherings. He would move—

"That the cordial thanks of the non-resident members of the Conference be given to the members residing in Plymouth and surrounding towns generally, and especially to Messrs. Clark, Balkwill, Codd, and Turney, and the other members of the Local Committee, for their kind and most successful efforts in organizing the present meeting."

Mr. GROVES seconded the resolution, which was put and carried unanimously.

Mr. R. J. CLARK (Local Secretary) briefly responded, and Mr. Balkwill also spoke of the good which these meetings did in bringing more closely together the chemists of the locality in which the Conference met, and making them feel that there were higher thoughts than those which merely belonged to their business, and that they were linked in some degree with the students in other fields of literature and science.

Mr. TURNEY proposed a hearty vote of thanks to the President for the ability and courtesy with which he had conducted the business of the meeting.

Mr. FRAZER (Glasgow) seconded the motion, which was put by Mr. Groves, as Vice-President, and carried unanimously.

The PRESIDENT in reply said it had been to him a source of very great gratification to be allowed the opportunity of meeting with so many of his old friends and associates, if he might so speak of his old pupils, and with others whose names had been familiar to him, but with whom he had not been personally acquainted. He could only assure the meeting that if his services had contributed in any way to the advancement of the object which they all had in view, no better reward could be afforded him for anything he had done, which he was sorry to say had been too little. He might say, however, that the manner in which he had been received throughout would be an encouragement to him to devote himself to the interests and objects of the Conference to a greater extent than he had hitherto done.

This terminated the proceedings.

THE EXCURSION.

On Thursday, August 16th, notwithstanding a smart shower just before the time fixed for embarkation, a considerable number of ladies and gentlemen accepted the invitation of the Local Committee to join in an excursion up the river Tamar. The programme, as previously sketched out, was closely followed. The boat proceeded up the river as far as Cotehele, the grounds of which were visited, then returned to Pentillie, where an ample lunch was followed by a stroll through the grounds, from which a magnificent view including the windings of the river was obtained. The kindness of Colonel Corydon in throwing open the grounds was recognised in three hearty cheers given by the company. After the company had once more returned on board, the *Eleanor* proceeded on her course down the river to Mount Edgcumbe, where some landed, whilst others went on for a run to the breakwater. By a little after six o'clock, however, the company had once more reunited in the "orangery" where, within view of numerous splendid specimens of the genus *Citrus*, bearing fruit and flowers in the open air, and within hearing of the musical strains of the capital band of the Royal Marines, "high tea" was served. Then, at the conclusion of a most successful day,—the threatening clouds of the morning having soon dispersed,—the President, Professor Redwood, speaking on behalf of the visitors, acknowledged the kindness and hospitality of the Local Committee, and also their appreciation of the generosity of the Earl of Mount Edgcumbe, which had allowed them to view his magnificent seat.

In concluding this notice, it may be said that from the beginning to the end of the Conference meeting there was ample evidence that no effort had been spared to secure the comfort and enjoyment of the visitors, and there can be no doubt that in the manifest appreciation of this fact, Messrs. Clark, Skinner, Turney, Codd, Balkwill, and the other members of the Local Committe, will find the most grateful acknowledgment of their labours.

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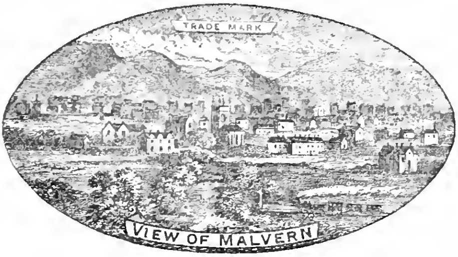
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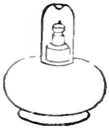
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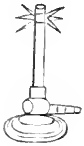
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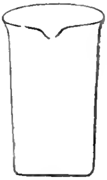

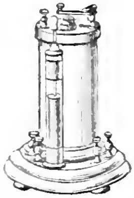
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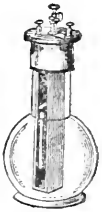
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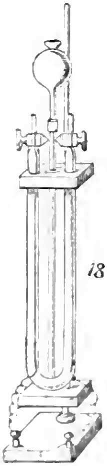
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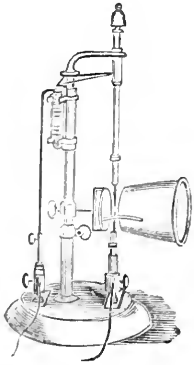

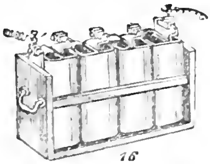
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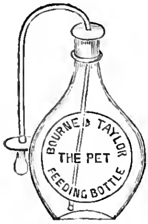

Fig. 1.

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Fig. 2.

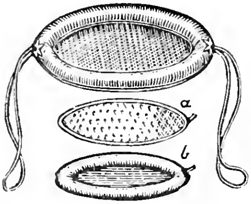

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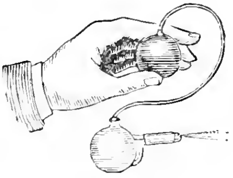
Fig. 1.



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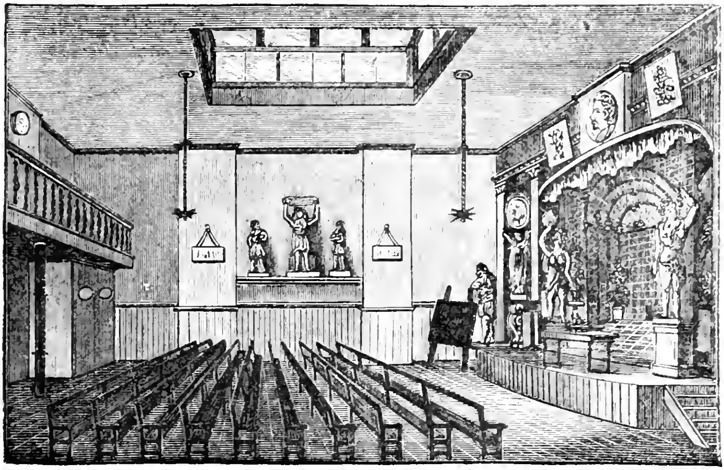

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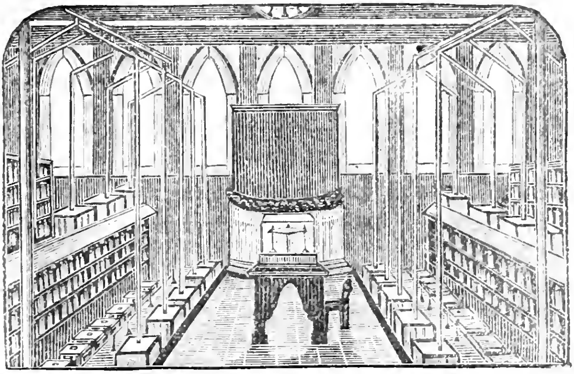

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Syrup of Peracetate of Iron and Quinine.
Solution of Peracetate of Iron.
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HUBBUCK'S PURE OXIDE is made by sublimation, and is warranted to contain 99·5 per cent of Pure Oxide.

Extract from "Pharmaceutical Journal" of May 1, 1856, *page* 486.

TRANSACTIONS OF THE PHARMACEUTICAL SOCIETY OF LONDON, Wednesday, April 2nd, 1856.

"On Pure Oxide of Zinc for Use in Medicine."

"Mr. REDWOOD directed the attention of the meeting to the very beautiful specimen of oxide of zinc on the table, which had been presented by the manufacturer, Mr. Hubbuck. Some of this oxide had been submitted to him for chemical examination, and finding it to be remarkably pure, and to possess in a high degree all the chemical and physical qualities required in oxide of zinc intended for use in medicine, he had suggested to Mr. Hubbuck that it might be brought under the notice of the Society.

"The specimen of oxide of zinc on the table was not only free from all impurities, but it possessed the other qualities required. It was a perfectly white, light, and smooth powder.

"Mr. HUBBUCK stated that the oxide of zinc which his firm made for use in medicine was free from impurities commonly occurring in the oxide made by combustion. The zinc was first thoroughly refined, and all the lead, arsenic, cadmium, iron, and other impurities removed. The pure oxide was then produced by combustion, abstracting only the very finest part of the product for medicinal purposes. About one-tenth or one-twelfth of the whole was thus set apart in producing that from which the sample exhibited had been taken; and this could be done, since their usual operations requiring them to make several tons of oxide every day, they could separate as much as was required in a state of absolute purity, while the remainder would be equally valuable as a pigment.

"The CHAIRMAN thought the mechanical condition of substances used in medicine was often a matter of considerable importance, and ought to be considered as well as their chemical composition. He thought the specimen before the meeting was a very perfect one in every respect, and he had no doubt it was the sort of oxide of zinc best adapted for use in medicine."

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DR. J. COLLIS BROWNE'S
CHLORODYNE.

IMPORTANT CAUTIONS
From Lord Chancellor SELBORNE, Vice-Chancellor Sir W. PAGE WOOD, and the Lords Justices of Appeal.

VICE-CHANCELLOR SIR W. PAGE WOOD, by whom the suit in Chancery was first heard, stated in his judgment that " Dr. J. Collis Browne was undoubtedly the Inventor of Chlorodyne, that the whole story of the defendant Freeman was as deliberately untrue as the falsehood he had deposed to with reference to the use of his Chlorodyne in the hospital."

THE VICE-CHANCELLOR also stated " that Chlorodyne was a fanciful name, and had application been made sooner, the Court would have given Dr. Browne protection."

LORD CHANCELLOR SELBORNE coincided with the judgment of the Vice-Chancellor upon this point, and stated "that had application been made at a proper time and place, the Court would have found means to restrain the Defendant from misrepresenting the decision of the Vice-Chancellor."

LORD JUSTICE JAMES, on appeal, stated in his judgment, "that the Defendant Freeman had made a deliberate misrepresentation of the decision of Vice-Chancellor Wood."

It was proved in court, on affidavit by Mrs. Forbes, of Paris, that the testimonial published in the "Times," November 14th, 1865, speaking of the great efficacy of Chlorodyne in Cholera, referred to Dr. J. Collis Browne's Chlorodyne, and that she never used any other, that she had written to the Defendant Freeman to that effect; notwithstanding which notice the Defendant publishes the said testimonial as referring to his medicine.

The Editor of the "Medical Times and Gazette," in his report on Chlorodyne, January 13th, 1866, gives information that the Chlorodyne referred to was the medicine introduced by a retired Army Medical Officer, which was Dr. J. Collis Browne. Still this is published by the Defendant as testimony to his medicine.

Numerous affidavits from eminent Physicians and others were produced in Court, stating that Dr. J. Collis Browne was the inventor of Chlorodyne, and that when prescribing they mean no other.

The Defendant himself publishes that his compound is in effect and composition quite different to any other preparation; nevertheless he assumes the name, testimonials, etc., of Chlorodyne.

The following eminent firms stated on affidavit that Dr. J. Collis Browne was the discoverer of Chlorodyne, and that they always supplied the preparation as the Original Chlorodyne, or when Chlorodyne was asked for—

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" John Bell & Co.
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Messrs. Cox & Gould.
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And every description of Druggists' Sundries, Paints, Colours, and Dyes.

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Mr. H. Coleby, of Nutley School, Uckfield, writes—"I can speak most highly of your 'Cobden's Quinine and Phosphorus Pills' as a cure for Neuralgia and severe pains in the head. My sister suffered much for months, without finding any relief till she tried a few doses, which completely cured her, and she has not had a return of the pain."

Mr. Martin, Chemist, Horsham, writes—"Please send another supply of 'Cobden's Quinine and Phosphorus Pills' as before, and if you feel inclined to use my name, do so, as I can safely say your Pills sell as well as the older Patent Medicines that have been advertised for years at a very great cost."

Mr. G. C. Cumsty, Chemist, Liverpool, writes—"Cobden's Pills are favourably spoken of, so it is not prudent to be without them."

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One Good Agent wanted in every town in England, whose name will be added to local advertisements. Terms from the—

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THE RESTORATIVE ASSIMILANT, 4/6 and 11/-. Cures Epilepsy or Fits, Indigestion, Faintings, Spasms, and all Nervous Diseases.

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11/- Size, 84/- per doz. 4/6 Size, 37/- per doz.
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In placing these Remedies before Retail Vendors, the Proprietor would call special notice to the following facts, which are of the greatest importance to Retailers :—

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Lastly—The Proprietor would call attention to the successful means and unusual facilities given to Retailers to enable them to push the sale of the medicines, especially in districts where they are but partially known. Such facilities consist not only in providing Agents with Almanacs, Treatises, Show-cards, Bills, etc., descriptive of the various remedies, but in further supplying them with **free samples** of the principal medicines, and in advertising the names of Agents in their own LOCAL PAPERS, as having the same for sale in their respective localities. Some of my articles will sell rapidly in the very poorest districts, and as I hold myself ready to take back my preparations which are slow of sale for others which are more in demand, **all Agents in reality have the goods on sale or return.** Address the Proprietor, Mr. O. P. BROWN, 2, King Street, Covent Garden, London.

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CAUTION.—See the Names "HIRST, BROOKE & HIRST," are on the Government Stamp.

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The Proprietors will send One Dozen, carriage free, to any Railway Station, on receipt of Post-office Order for 27s.

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In Boxes, 1s. 1½d. and 2s. 9d. each.

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For Foot Rot in Sheep, Diseased Thrushes in Horses, and Foul in the Feet of Beasts.

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Authentic Testimonials enclosed.

Cures Rheumatism, Neuralgia, Gout, Tic, Lumbago, Sciatica, Stiff Joints, Sprains, Bronchitis, Sore Throat, Stiff Neck, Mumps, Faceache, Cramp, Chilblains, etc.

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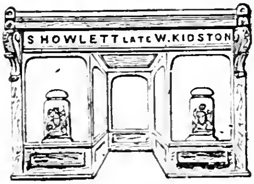
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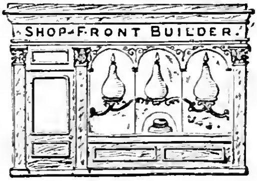
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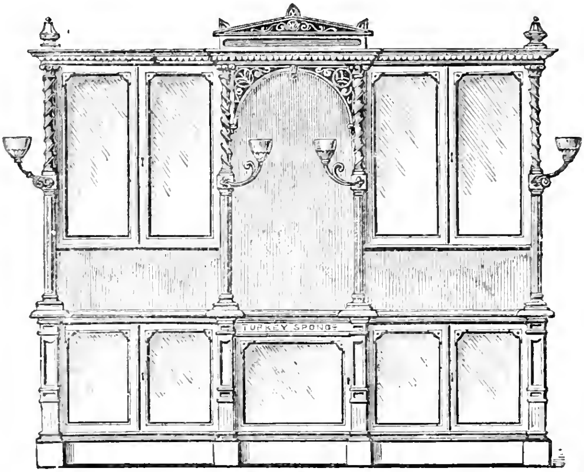
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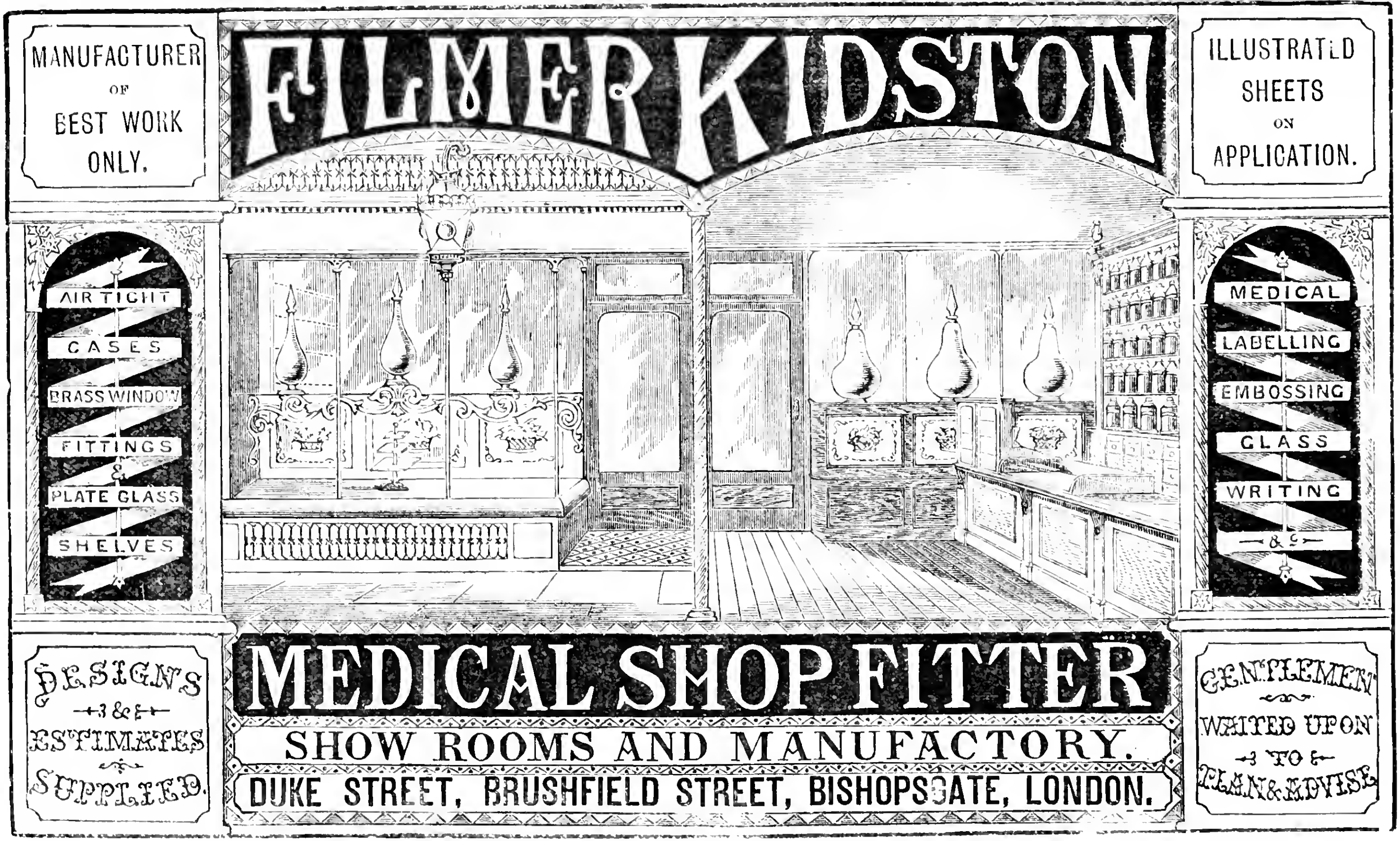

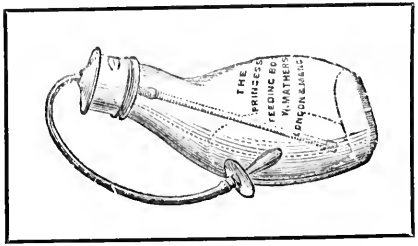
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In white, grey, and black hair, of various degrees of hardness, to suit the most delicate, without risk of injury to the skin.

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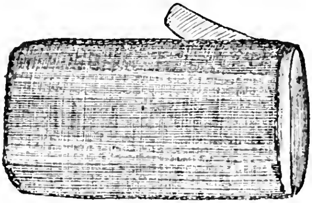

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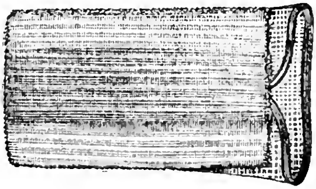

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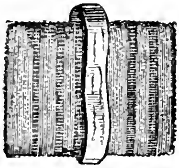

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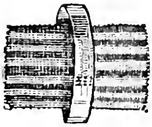

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For cleaning and softening the hands, and for the bath. In 1 doz. boxes; 8s. per doz. Retail, 1s. each.

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Hair on both sides; for softening the hands and for the bath, 12s. per doz. Retail, 1s. 6d. each.

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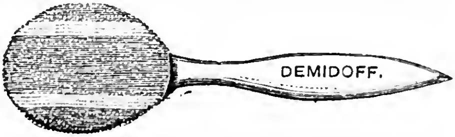
42s. per doz. Retail, 5s. each.



FLESH STRAP OR BELT, AND BATH STRAP.

Ladies' quality, light hair and soft pile. Gents' quality, black or grey, and pile of various degrees of hardness. 42s. per doz. Retail, 5s. each.

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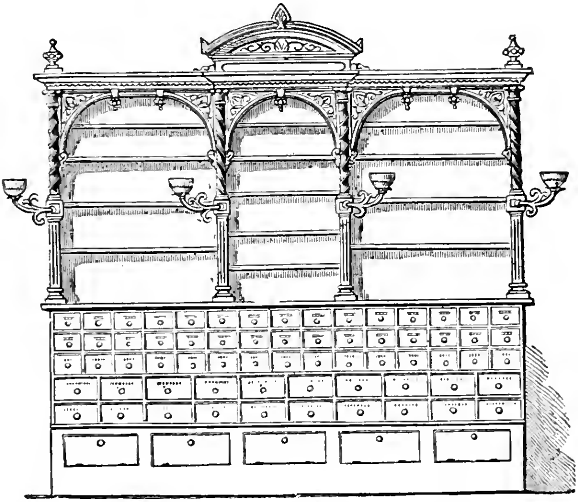

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N.B.—Experienced Workmen sent to any part of the United Kingdom.

SHILLCOCK'S PATENT LEECH VASE

Is now fitted with Earthenware as well as Metal Plates; both supplied at the same charges; viz., for 100 Leeches, 22/-; 50, 16/6; 25, 13/-.

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"Mr. J. B. SHILLCOCK.—Sir,—I have had one of your Leech Vases in use for several months, and am very much pleased with it, as it keeps the Leeches healthy, and I rarely find a dead one.

"Yours, etc., C. W. REED."

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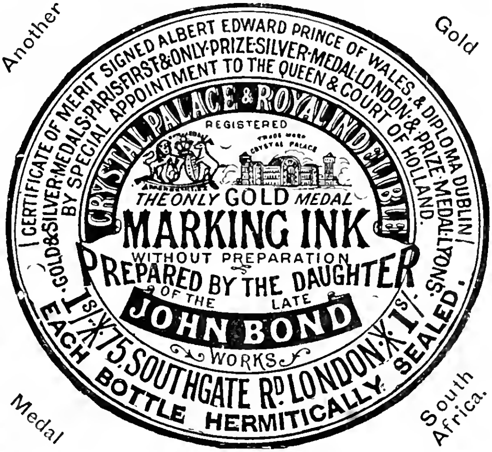

Fac-Simile of 6d. and 1s. Labels.

CAUTION.—I am determined, at any cost, to prevent any imitation of this fac-simile of Label.

CAUTION.—BOND'S MARKING INK (Crystal Palace).—Wholesale and Retail Dealers are hereby WARNED that LEGAL PROCEEDINGS are now PENDING against the MANUFACTURER of a MARKING INK, which is being Sold with colourable imitations of the Trade Marks of the Manufacturer of the above Ink, and that similar proceedings will be taken against all other persons selling the same. The genuine label has the words, "Prepared by the Daughter of the late John Bond, 75, Southgate-road, London, N." Trade Marks are not only symbols, but those characteristics and general appearances to mislead the public. See action, tried Court of Common Pleas. Jan. 15 and 16, 1876.—Wills and Watts, 53, Charter Lane, Doctor's Commons, Solicitors to the Proprietor; J. P. Yeatman, Esq., barrister-at-law, Standing Counsel.

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IMPORTANT TO FARMERS, GRAZIERS, SHEPHERDS, Etc.

LUDDINGTON'S

CELEBRATED

HORSE AND CATTLE MEDICINE

STANDS UNRIVALLED AS A

Safe, Effectual, and Speedy Remedy for Colic or Gripes in Horses; Diarrhœa or Scour in Calves, Foals, Sheep, Lambs, etc.; for Cows in Difficult Calving, Mares in Difficult Foaling; and especially for Ewes in Difficult Lambing, it being a certain preventive of Paining, etc. As an External Application for Fly Galls, Ulcerated and Sagged Udders, Bites of Dogs, Swellings, etc., it will be found safe and greatly beneficial.

SOLD IN BOTTLES, 2s. 6d., 5s., and 10s. EACH, BY ALL CHEMISTS.

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TOMLINSON & HAYWARD, CHEMISTS, LINCOLN.

CAUTION!—It having come to T. Luddington's knowledge that certain persons are representing they have purchased the sole right to make and sell a preparation known as "Luddington's Driffield Oils," he begs most distinctly to state that the above Medicine has never been sold under such a title, and therefore wishes to warn the public against any such misrepresentations.

TOMLINSON AND CO.'S

BUTTER POWDER,

Lessens the Time of Churning, Increases the Quantity, Improves the Quality, Removes the Unpleasant Flavour of Cake, Turnips, Mangolds, Wild Garlic, Dead Leaves, &c., and Produces Good Firm Butter at all Seasons of the Year.

Sold in Boxes, 3d., 6d., 1/., 2/6., and 7/6 each, by all Chemists.

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TICKS, LICE, SCAB, FOOT AND MOUTH, AND ALL CONTAGIOUS DISEASES.

THE "GLYCERINE DIP,"

FOR SHEEP AND LAMBS,

Is a certain preventive and cure of Scab; is also destructive to Ticks, Lice, and all Parasites infesting the Skins of Sheep and other animals; its emollient and stimulating properties greatly promote the Growth of the Wool, and being a Powerful Disinfectant it arrests the Spread of Contagious Diseases. It does not discolour or act injuriously upon the natural yolk of the Wool, but feeds the Fleece and maintains the natural lustre.

Sold by Agents in every Market Town. Price 6d. per Pound, in various size Tins and Drums.

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The "GRANULAR BROWNING"

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Rich Colour and Superior Flavour to Roasted Meats of every Description, Chicken and Game Gravies, Soups, Beef Tea, etc.

SOLD IN BOTTLES, 1s. and 2s. 6d. each, by Chemists, Grocers, and Italian Warehousemen

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To be obtained of Patent Medicine Warehousemen.

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LONDON, S.E.
ESTABLISHED 1855.

TO CHEMISTS AND DRUGGISTS.

The undermentioned goods wil be found to have a ready sale. Show tablets and counter bills supplied. Agents appointed. Terms on application, or order through your Wholesale House.

SPRATT'S PATENT MEAT FIBRINE DOG CAKES, and **SPRATT'S PATENT POULTRY** and **GAME MEAL.**

SPRATT'S PATENT MEDICINES FOR DOGS, viz.:—Mange Lotion, Tonic Condition Pills, Cough Pills, Jaundice Pills, Rheumatic Pills, Purging Pills, Alterative Powders, Worm Powders, Distemper Powders, Liniment for Sprains, and Cure for Canker of the Ear.

THE KENNEL MEDICINE CHEST, Price 25s., contains all the above remedies, and in addition, Lancets, Seton Needle, Scissors, &c.

SPRATT'S PATENT DOG SOAP instantly destroys all vermin, and obviates skin disease.

For particulars of any of the above, address **SPRATT'S PATENT,** Henry Street, Tooley Street, London, S.E. Wholesale Agents for the Soap and Dog Medicines:—Barclay & Sons; Sanger & Sons; Sutton & Co.; F. Newbery & Sons; Lynch & Co., London. Raimes & Co., Edinburgh, York, and Liverpool; Ravensdale Mill Co., Dublin; Woolley, Sons & Co., Manchester; Taylor, Gibson & Co., Newcastle-on-Tyne; and of all Wholesale Houses.

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FRED LEWIS'S
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2 6 size	18/- per doz.	*A liberal discount to Shippers and the Trade.*
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Handsome Show Cards.

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KNEADING & MIXING MACHINE,

For Mixing Dry Powders, and **Kneading Pill Masses, Gum, Lozenge,** and other **Paste,** etc., etc., combines the qualities of a powder blender with those of a **kneading machine,** and so enables the finishing of **compound masses** out of their **dry and liquid ingredients** in **one operation.** It saves 80 per cent. in time and labour.

Among the many Testimonials I have are those from **Mr. Robert Hampson,** Manufacturer of Pharmaceutical Preparations, 205, St. John Street Road, London, E.C., who says:—"The whole operation of forming a **perfectly blended** pill mass is rendered by the Mixer a marvellously quick operation, and is indeed more successful than any other method I have met with." From **Messrs. Allen & Hanburys,** Wholesale Druggists and Chemists, Plough Court, Lombard Street, London, E.C., who say:—"We have one of Mr. Pfleiderer's Machines in use for making Pill Masses, and we find that it **excellently accomplishes** the twofold operation of **Mixing and Kneading.**" From **Mr. John Walton,** the Laboratory of Animal Medicines, Croydon, Surrey, and at 9, Imperial Arcade, Ludgate Hill, London, E.C., who says:—"My various Pill and Horse-ball Masses are now produced with an expedition and in a **state of perfection** not attainable by any other means, whilst the **saving of time and labour is immense.**" From **Messrs. Whelpton & Son,** 3, Crane Court, Fleet Street, London, E.C., who write on the 21st of March:—"We have pleasure in writing that we are perfectly satisfied with your Kneading and Mixing Machine. It does its work well by thoroughly kneading the mass in such a manner as is impracticable to be done by mere hand labour; and, besides this, the **after operations** are very much **improved and quickened.**"

The Machines are made **to order** in all sizes, and to suit any special requirements. Up to the capacity of about 25 lbs. of mass they are generally kept in stock, or are in progress of construction.

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MILLARD'S TOILET REQUISITES AND SPECIALITIES.

The attention of the Trade and Export Purchasers is called to the undermentioned articles. Command a ready sale wherever introduced.

MILLARD'S ARECA NUT TOOTH PASTE.—Highly recommended for the Teeth and Gums. In pots, 1s. each. Wholesale—8s. per doz.

MILLARD'S CHERRY TOOTH PASTE.—An elegantly-prepared Dentifrice for the Teeth and Gums. In Pots, 1s. each. Wholesale—8s. per dozen.

MILLARD'S 'INVISIBLE' FACE POWDER.—An exquisite Toilet Preparation for Beautifying and Preserving the Complexion. Specially adapted for use in Hot Climates. In Packets, 6*d*., and Enamel Boxes, with Puff, 1s. and 2s. each. Wholesale—3s., 8s., & 16s. per doz.

MILLARD'S SUPERFINE HIGHLY SCENTED VIOLET POWDER.—In Packets, 4*d*., and Fancy Octagon Boxes, 6*d*., and 1s. each. Wholesale—2*s*. 6*d*., 4*s*., and 8*s*. per dozen.

MILLARD'S PREPARED FULLER'S EARTH.—In Fancy Octagon Boxes, 6*d*. and 1*s*. each. Wholesale—4*s*. and 8*s*. per dozen.

MILLARD'S INVISIBLE EAR WOOL. 3*d*. and 6*d*. Packets. Wholesale, 2*s*. and 4*s*. per dozen.

MILLARD'S IMPROVED BREAST EXHAUSTERS. Each in a Box, 1*s*. Wholesale, 7*s*. per dozen.

MILLARD'S IMPROVED NIPPLE SHIELDS. No. 1. With Teat. Each in a Box, 6*d*. Wholesale, 3*s*. 6*d*. per dozen.

MILLARD'S IMPROVED NIPPLE SHIELDS. No. 2. With Tube, Teat, and Brush. Each in a Box, 1s. Wholesale, 6*s*. per doz.

MILLARD'S PAPIER DE RIZ. A superior prepared Wafer Paper. 6d. Boxes. Wholesale, 3*s*. 6*d*. per dozen.

MILLARD'S ATMOSPHERIC PERFUMERS. 6d. and 1s. Wholesale, 4*s*. and 7*s*. per dozen.

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Retail 1*s*. per Bot. **MRS. BATCHELOR'S HAIR COLOR RESTORER.** Wholesale 8*s*. per doz

MILLARD'S IMPROVED FEEDING BOTTLES.

6*d*. White Glass, White Earthenware Caps, 4*s*. per dozen. 6*d*. Green Glass, White Earthenware Caps, 3*s*. 9*d*. per dozen. 6d. Green Glass, Wood Top Corks, 3s. 6*d*. per dozen. 1s. White Glass, White Earthenware Caps, complete with Tube and Bottle Brushes, in Card Boxes, 7*s*. 6*d*. per dozen.

The whole of the above-mentioned Articles are subject to the usual Trade Discount. Special Terms to Wholesale and Export Purchasers.

☞ PROFITABLE AGENCY FOR CHEMISTS.

MRS. BATCHELOR'S HAIR COLOR RESTORER

SPEEDILY RESTORES GREY HAIR TO ITS ORIGINAL COLOR AND BEAUTY.

ONE SHILLING PER BOTTLE.

NETT WHOLESALE CASH WITH ORDER PRICES:—

1 dozen	7s. 0d.
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12 dozen	6s. 6d.

Handbills and Show Cards supplied. Orders for 6 dozen and upwards, name and address printed at foot of Handbill.

Sole Proprietors: R. H. MILLARD & SONS, 40, Charterhouse Square (late of 44, Barbican), London, E.C., Wholesale and Export Druggists' Sundrymen and Patent Medicine Vendors.

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Just Published, gratis, The Experience of an Octogenarian in the HYGEIAN SYSTEM OF JAMES MORISON, the Hygeist, and of his VEGETABLE UNIVERSAL MEDICINE. By John Fraser, of No. 10, George Street, Johnstone, Scotland.

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IMPERCEPTIBLE CURATIVE TRUSS,

Deformity Instruments, Artificial Limbs, Elastic Stockings, Improved Chest Expanders, and other Invalid Appliances.

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H. ERHARDT & Co.,

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Specially prepared for tying over Jams, Jellies, Marmalade, Drugs, Chemicals; for Capping Bottles of Perfumes, Medicines, and Chemicals, and for Packing and Covering Greasy Articles, etc., etc.

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WHITE SPLITS,
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FRENCH SKINS.

Samples Post Free.

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For covering Cold Cream, Ointments, Plaisters, etc., wrapping Jujubes, Scented Soaps, Violet Powder, Linseed Meal, Horse Balls, and other greasy, perfumed, or adhesive substances, without any of the objectionable results of using tin foil, and

AT HALF THE COST.

	Per box of 50 Sq Ft.	Per Ream.
White	2*s*. 0*d*.	30*s*. 0*d*.
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TRADE MARK.

Machinery Oil, Warranted free from Mineral Oil.

WHITE STAR OIL TRADE MARK

Test about 140. Water White, and almost free from smell.

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COLZA OIL.

Extra Pale and Sweet.

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FOR PRICES AND TERMS, APPLY AS ABOVE.

NEW EDITION.

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"The Oilmerchants' and Drysalters' Price Book," by W. Stavenhagen Jones, is likely to be a useful compilation, inasmuch as it contains a very complete list of the goods which might be expected in such a store as that indicated in the title. It is printed on superior paper, and is neatly bound. Every right-hand page is left blank, and very faint lines correspond with the printed lines on the opposite page.—*The Chemist and Druggist.*

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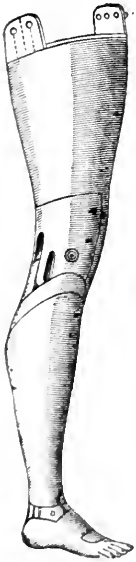


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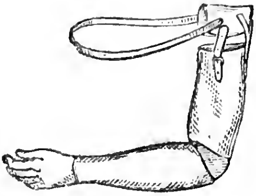
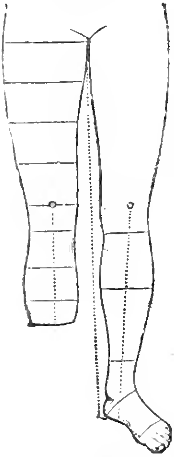
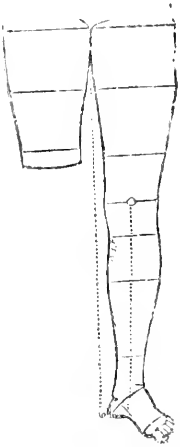
WELTAUSSTELLUNG 1873. WIEN.
DEM VERDIENSTE

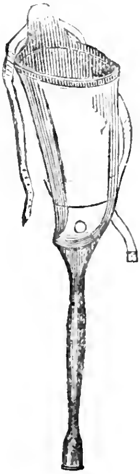
With Elbow-Joint and Upper Arm-Piece.



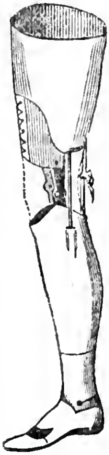
Amputation above Elbow. With Elbow-Joint.



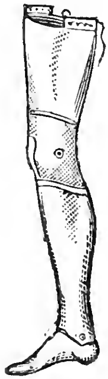




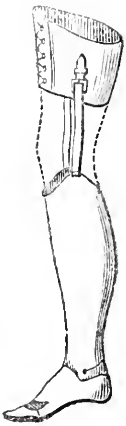
Bucket Leg, with Knee-Joint and Stop, enabling the patient to bend the knee when sitting down.



Knee-Joints and Thigh Support, Amputation below Knee.



Artificial Leg, with all the Articulations. Amputation above Knee.



For Long Fleshy Stump.—Without Thigh-Support. Artificial Foot. Joints at Toe and Ankle.

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PURE WHITE GLYCERINE SOAP.

Richly perfumed, and possessing the Emollient and Cosmetic properties of Glycerine for the Skin and Complexion.

1s. 6d. boxes of Three Tablets. 12s. per dozen boxes.

Note.—The extraordinary merit and consequent unprecedented demand for WHITAKER & GROSSMITH'S PURE WHITE GLYCERINE SOAP, has caused numerous unprincipled imitations of their new style of Box and Labels. To save disappointment, purchasers should carefully observe the name of the Sole Proprietors, Whitaker & Grossmith, Perfumers, London.

W. & G. also beg to solicit notice of their other "Specialities," comprising:—Centfleur, Jockey Club, Real Old Musk, Sandringham, Semi-cut Bars, New Oval and Assorted Soap Tablets, Centfleur Pomade and Oil, Oleine, Brilliantine, Cantharidine, and Lime Creams, etc. Centfleur, Pearl of Perfumes, and other Bouquets, Anglo-Cologne, Lavender Water, &c., with Patent Sprinkling Caps. All of acknowledged merit, and put up in attractive forms, which command a ready and increasing sale.

Sample Orders, Price Lists, and Terms of the Manufacturers,

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BENBOW & SONS,

WHOLESALE AND EXPORT PERFUMERS,

FANCY SOAP MAKERS, BRUSH MANUFACTURERS, etc.,

12, LITTLE BRITAIN, LONDON, E.C.

BENBOW'S Prize Medal Toilet Soaps. Honey, Glycerine, Elderflower, Rose, Almond, Pearl, Curd, Lavender, Brown Windsor, in 3*d.*, 4*d.*, and 6*d.* Tablets, price 1*s.* 9*d.*, 2*s.* 6*d.*, and 3*s.* 6*d.* per doz.; ½-lb and 1-lb Bars, 4*s.* and 8*s.* per doz.

Note.—*Transparent* Glycerine *same prices* and sizes as above.

BENBOW'S Brilliantine for the Hair. Perfumed Violet, Jasmin, Rose, Millefleurs, etc. Price 8s., 12s., 16s., 28s., and 36s. per doz.

BENBOW'S Bay Rum Hair Wash. In sprinkler-top bottles, 8s. per doz.; and in separate cases, 12s., 18s., 24s., and 36s. per doz.

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BENBOW'S Rose Tooth Paste, 8s. and 12s. per doz.

BENBOW'S New Transparent Cosmetics, in slide cases, 4s. and 8s. per doz.

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BENBOW'S Lime Juice & Glycerine, 4s., 8s., and 12s. per doz.

BENBOW'S Shilling Perfumes. The cheapest and best in the trade. In large round bottls, handsome labels, in circular boxes, 8s. per doz.; or in cabinets of three dozen, no extra charge. Very saleable.

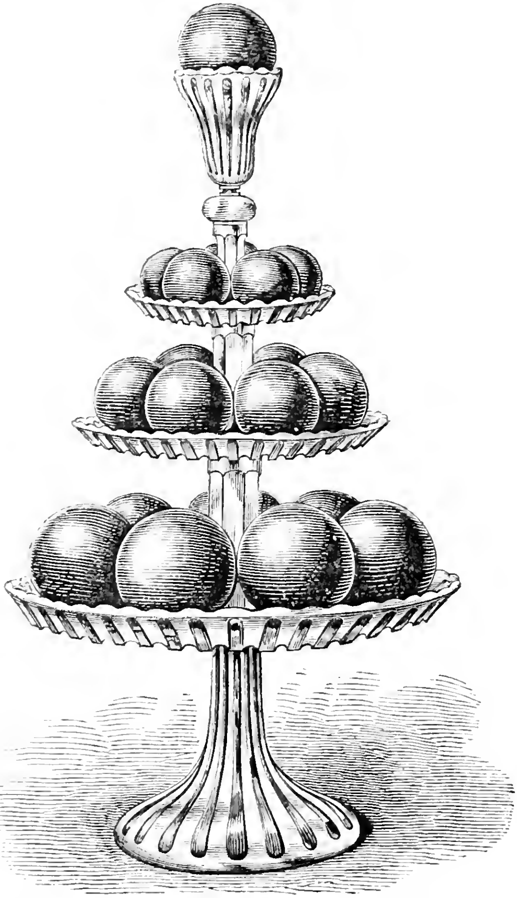
BENBOW'S Triple Extracts, 8s., 12s., 18s., 24s., and 36s. In stoppered bottles.

Jockey Club, Ess. Bouquet, Frangipane, White Rose, New Mown Hay, Upper Ten, Ylang Ylang, &c., &c.

BENBOW'S Medicated Dog Soap, 4s. per doz.

A large assortment of Hair, Tooth, and Nail Brushes, in Wood, Bone, and Ivory.

All BENBOW & SONS' Preparations can be obtained through all Patent Medicine Houses, Druggists, and Druggists' Sundriesmen, or direct from the Makers.



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THE GLENFIELD STARCH.

THE QUEEN'S LAUNDRESS USES NO OTHER.
R. WOTHERSPOON & Company, Glasgow and London.

VINAIGRE DE BORDEAUX.

W. & S. KENT & SONS,

Importers for forty years of finest French Wine Vinegar, old and well matured, offer it in hogsheads and tierçons. Terms and Samples on application.

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N.B.—Pure Flavourless Sp. Vini.

EUGENE RIMMEL,

PERFUMER TO H. R. H. THE PRINCESS OF WALES.

Star of India, Jungle Flowers, Jockey Club, Wood Violet, Ihlang-Ihlang, and other choice perfumes for the handkerchief.

Toilet Vinegar, of world-wide celebrity.

Toilet Water, Lavender Water.

Florida Water, Eau de Cologne.

Lime Juice and Glycerine, the best preparation for the Hair.

Philocome, Australian Hair Wash.

Glycerine, Honey, Dugong, Carbolic, Windsor, Bath, and other Soaps.

Violet and Rice Powder. Velvetine, a superior imperceptible toilet powder.

Rimmel's Lotion for the complexion.

Aquadentine, a new floral extract for cleansing and whitening the teeth.

Photochrome, a Pomade to restore grey hair and beard to their original colour, through the agency of light.

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TRADE MARK. REGISTERED.

Toilet Waters and Perfumes Shipped in Bond at a great reduction. A complete Illustrated List on application at the

WHOLESALE & SHIPPING WAREHOUSE, 96, STRAND, LONDON.

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FEBRINE SALINE.

Patronised by the Medical Faculty.

As a preventive of Fever, Liver Complaints, Headache, Heartburn; for Skin, and all unhealthy diseases. A vegetable production. Free from mineral poisons. Forms a salubrious, effervescing drink, suitable for all climates, and persons young or old.

Sold in Bottles, 2s. each.

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on each Preparation.

BOIL PLASTERS.—A certain cure for Boils, without the use of poultices, fomentations, etc. Sold in Packets, 1s. 1½d. and 2s. 9d. each

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DANDELION, CHAMOMILE, QUININE EXTRACT, SARSAPARILLA, AND TURKEY RHUBARB PILLS

(Dr. Brown's Recipe).

The virtues of these Pills are as follows: they give strength to the stomach; they give strength to the nervous system; they restore the appetite; they prevent the accumulation of bile and all unhealthy secretions; they require no confinement in diet. Sold in Boxes, 1s. and 2s. 6d. each.

THE BEST DENTIFRICE.

One trial proves its great and unequalled efficacy. The ODONIPTIC LIQUID DENTIFRICE. Patronised by Royalty, the aristocracy, upper and middle classes. An exquisitely delicate tooth and mouth wash, for cleansing and preserving the teeth and gums, and for purifying and sweetening the breath. It produces a beautiful cleansing lather and delightful fragrance. It is used and highly recommended by the most eminent dentists. Superior to tooth paste or powders, being free from grit. Sold in Bottles, 1s. 6d., 2s. 6d., and 4s. 6d. each.

SOLARIFERINE, or Sunny Hair Wash (entered at Stationers' Hall). Harmless and free from Smell. For the production of golden hair.

MOUSTACHEOTIQUE (entered at Stationers' Hall). For cultivating and producing the Moustache and Whiskers, as patronised by the Army.

May be obtained through all Patent Medicine Houses.

Manufacturers of Golden Dye, or Peroxide of Hydrogen (12 volumes).

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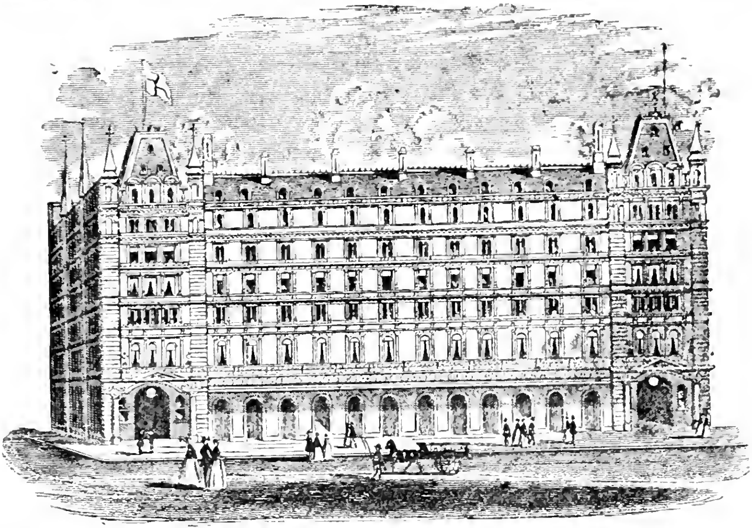

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TRADE MARK

GOLD MEDAL,
PARIS,
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AND AT
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1876.

TRADE MARK

(GREAT REDUCTION OF PRICE.)

The Ten Years' Treaties with foreign Agents being now terminated,

E. H. THIELLAY'S

EAU FONTAINE DE JOUVENCE, GOLDEN.

Or, GOLDEN HAIR WASH,

For changing Dark Hair into Flaxen or Sunny Shades.

Wholesale at	20/-	30/-	40/-	54/-	80/-	96/-	per dozen.
Retail at	3/-	5/-	7/-	9/-	12/6	16/-	per bottle.

ALSO

EAU FONTAINE DE JOUVENCE IN EVERY SHADE.

Auburn.
Dark.
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Restorer.
Progressive.

WHOLESALE DESCRIPTIVE PRICE LIST ON APPLICATION.

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DYES FOR THE MILLION!

CRAWSHAW'S CRYSTAL DYES.

Beautiful Colours—Easy to use—Economical in price—Will go six times as far as the ordinary Liquid Dyes—One Sixpenny Box will dye a Lady's Dress.

6D. BOXES CRAWSHAW'S CRYSTAL DYES, in ½-gross (7 dozen) Counter Cases, with glass lid, 48s. per gross.

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USUAL TERMS. TO BE HAD FROM ALL THE WHOLESALE HOUSES.

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After the declaration of Dr. Chandler, of America, and Professor Matthews, of London, F.K.C.S., as to the poisonous effects of the Lead Restorers, why injure the health by using them?

Lineham's Registered World's Hair Dressing Balsam is unequalled for removing Scurf and preventing Baldness. Perfumed with Otto, 11s. and 24s. per dozen. The best of the best.

Lineham's British Excelsior Grey Hair Regenerator will restore speedily and stimulate the growth amazingly. 18s. per dozen.

Professor Attfield's, F.R.C.S., Certificate with each Bottle.

Lineham's Instantaneous Grey Whisker and Hair Dye, in cases, with Brush and complete instructions. 18s. per dozen.

"BRUNEL TERRACE, NOTTINGHAM, *Nov. 18th*, 1876.

"DEAR SIR.—Permit me to thank you for recommending to me LINEHAM'S HAIR DRESSING BALSAM. It is the very best preparation I have ever used for the removal of dandriff from the head. After using other remedies for many years, I find this the most effectual.

"Yours faithfully,

"To Mr. Carter, Hair Dresser, Poultry, Nottingham." "J. B. GAYTON."

Important Reduction in Price!!!

In consequence of the great sale of these TOOTH BRUSHES, the Prices in future will be:—

Letter		Price	
Letter A	Flat cut,	78s. per gross.	Assorted, 84s. gross.
,, B	Penetrating,	84s. ,,	
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,, D	Round cut,	84s. ,,	
,, E		90s. ,,	

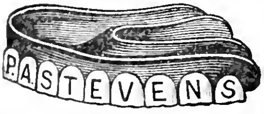
Letter E Alternate Knot of White and Unbleached bristle, two Textures.

A perfect combination, as it can be used as a soft or hard brush at pleasure!

Children's Brushes assorted, same patterns, 48s. per gross. N.B.—A number of second quality, large size, suitable for export or Cutting Trade, 60s. and 66s. gross, less discount, direct, or through Wholesale Houses.

NOTE!—As these are Registered Patterns by Act of Parliament (not Stationers' Hall), purchasers are requested to see every brush is marked Mr. Salter's Perfect Pattern and Registration Mark. Legal proceedings will be taken in case of any infringement of the registration or Trade Mark. Mr. Salter will feel obliged by information being given to Messrs. Lumley & Lumley, Solicitors, Old Jewry Chambers, London.


GREENISH'S PALMA CHRISTI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PAINLESS DENTISTRY.

ARTIFICIAL TEETH.

MR. G. H. JONES,

Surgeon-Dentist,

57, GREAT RUSSELL ST., LONDON, W.C.
(Immediately opposite the British Museum),

Has obtained

HER MAJESTY'S ROYAL LETTERS PATENT

For his Improved Method of adapting

Artificial Teeth by Atmospheric Pressure.

Note.—Improved Prize Medal Teeth (London and Paris) are adapted in the most difficult and delicate cases, on a perfectly painless system, extraction of loose teeth or stumps being unnecessary, and by recent scientific discoveries and improvements in mechanical dentistry detection is rendered utterly impossible, both by close adjustment of the artificial teeth to the gums and their life-like appearance. By this patented invention complete mastication, extreme lightness, combined with strength and durability, are insured; useless bulk being obviated, articulation is rendered clear and distinct. In the administration of Nitrous Oxide Gas Mr. G. H. Jones has introduced an entirely new process.

TESTIMONIAL.

"My dear Sir,—Allow me to express my sincere thanks for the skill and attention displayed in the construction of my Artificial Teeth, which render my mastication and articulation excellent. I am glad to hear that you have obtained Her Majesty's Royal Letters Patent to protect what I consider the perfection of Painless Dentistry. In recognition of your valuable services you are at liberty to use my name.

"G. H. Jones, Esq. "S. G. HUTCHINS.

"By appointment, Surgeon-Dentist to the Queen."

Pamphlet forwarded Gratis and Post Free.

A LIBERAL DISCOUNT TO THE MEDICAL PROFESSION, CHEMISTS, AND DRUGGISTS.

PARTICULARS ON APPLICATION.

MESSRS. STONE & DOMINY,

Dentists and Manufacturers,

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Execute Mechanical work, Teeth plate, and materials inclusive, at per Tooth, 1*s.* 6*d.* Their connection personally requiring the services of a Dentist is treated as Professional, and charged Mechanical prices.

The Mechanical Department, School and Manufactory is at 48, *and the Operative and Surgical Dentistry more especially at* 35, *under* Mr. DOMINY.

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AMERICAN DENTIFRICE.

Prepared only by WILLIAM DARLING, Chemist, Manchester.

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THE FACULTY pronounce it "the most nutritious, perfectly digestible beverage" for BREAKFAST, LUNCHEON, or SUPPER, and invaluable for Invalids and Children.

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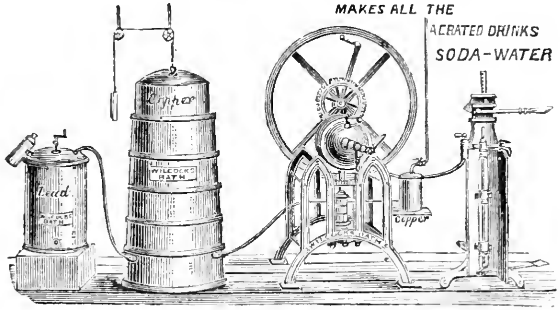
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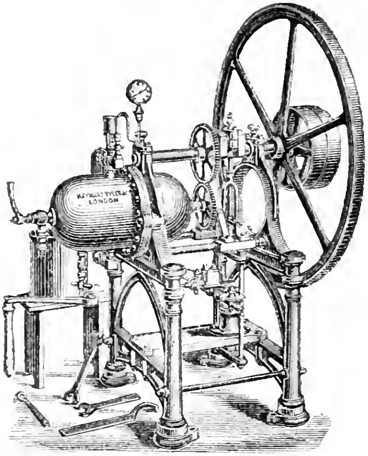

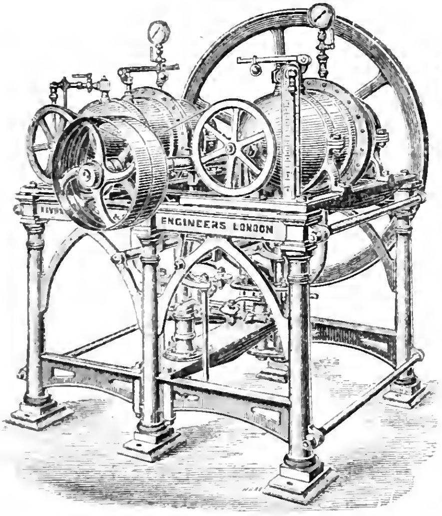
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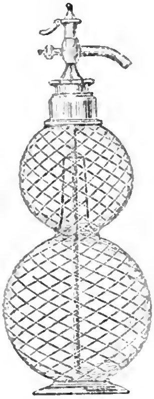

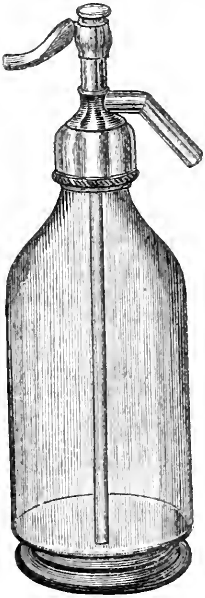

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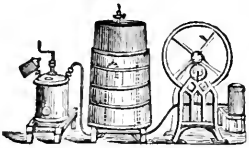

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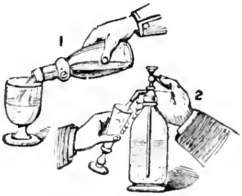

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[1878.

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NAME.	PROPERTIES.	TRADE PRICES.			
		Per Dozen.		Per Orig. Pkg.	
		Qts.	Pts.	Qts.	Pts.
Adelheidsquelle	Iodized	12/	...	48/	...
Aix-la-Chapelle	Sulphurous	16/	10/	70/	44/
*Apollinaris (Glass)	Acidulated, Gaseous	6/3	5/	23/	*36/
Do. (Stone)	Do.	6/3	5/	22/	17/6
5 % discount on orders for 20 hampers.					
Bareges	Sulphurous	12/	9/	48/	36/
Birmenstorf	Alkaline	12/	...	44/	...
Bonnes	Sulphurous	12/	9/	48/	35/
Bourboule, La	Saline	11/	...	42/	...
Bussang	Alkaline	7/	...	28/	...
Carlsbad	Do. & Purgative	9/6	...	38/6	...
Condillac	Do.	6/	...	25/	...
Contrexeville	Do.	10/	...	38/	...
Ems	Do.	8/	...	30/	...
Fachingen	Acidulated, Gaseous	6/	4/	23/	16/
*Friedrichshall	Saline, Aperient	11/	7/6	*26/	*35/
Giesshubler	Alkaline, Ferruginous.	8/	5/6	29/	20/
*Harrogate	Sulphurous	7/	...	*20/	...
Homburg	Saline, Gaseous	10/	...	40/	...
*Hunyadi-Janos	Do. Aperient	16/6	13/6	*30/	50/
Kissingen	Alkaline, Gaseous	11/6	...	46/	...
Krankenheil	Iodized	14/	...	54/	...
*Kreuznach	Do.	11/	...	*26/	...
Marienbad	Alkaline, Purgative	10/	...	40/	...
*Missisquoi	No Analysis given	25/	...	*50/	...
*Orezza	Ferruginous	12/	...	*28/	...
Plombieres	Alkaline	9/	...	36/	...
Pougues	Do.	9/	...	36/	...
*Pullna	Saline, Purgative	12/	8/6	*36/	*25/
Pyrmont	Ferruginous	14/	...	52/	...
Renaison	Acidulated, Gaseous	6/	...	23/	...
Roisdorf	Do. Do.	5/6	...	21/	...
Saint Galmier	Acidulated, Gaseous	5/6	...	21/	...
*Saint Moritz	Ferruginous	13/	...	*32/	...
Saratoga	Alkaline, Gaseous	...	12/	...	47/
Schwalbach	Ferruginous	8/	...	30/	...
Schwalheim	Acidulated, Gaseous	7/	...	28/	...
Seltzer	Do. do.	6/	4/	22/	15/6
Spa	Ferruginous	9/	...	36/	...
Vals	Alkaline, Gaseous, &c.	8/6	...	32/	...
Vichy (de l'Etat)	Do. do.	8/6	7/6	31/	27/
Do. (Sundry)	Do. do.	7/	6/6	25/	23/
Weilbach	Sulphurous	10/	...	40/	...
Wildungen	Alkaline	11/	...	43/	...

* Original Packages of Apollinaris, Glass pints, contain 100. Friedrichshall, 30 qts. or 60 pts.; Harrogate, 36 qts.; Hunyadi-Janos, 25 qts. or 50 pts.; Kreuznach, 30 qts.; Missisquoi, 24 qts.; Orezza, 30 qts.; Pullna, 40 qts. or 40 pts.; St. Moritz, 30 qts. With these exceptions all Original Packages contain each 50 quarts or pints.

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THE APOLLINARIS COMPANY, LIMITED will Supply this Water TO THE TRADE, as follows:—

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100 „ Pints . . .	35s.	100 „ Pints . . .	38s.

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In London.		Carriage paid to any Railway Station in the United Kingdom.	
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100 „ Pints . . .	42s.	100 „ Pints . . .	46s.

The Company does not sell less than 50 Quarts or 100 Pints.

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THE BEST AND MOST AGREEABLE NATURAL APERIENT.

The "LANCET."

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Orders for 20 Cases and upwards are executed at Southampton, Bristol, Liverpool, Glasgow, Dublin, Belfast, Aberdeen, Dundee, Leith, Newcastle, Hull, Goole, Grimsby, at the above prices, ex ship. A liberal discount is allowed to dealers on orders for 10 cases and upwards.

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